AURORA®

Photovoltaic Inverters

INSTALLATION AND OPERATING MANUAL

Model number: PVI-3.8/4.6-I-OUTD *Rev. 1.3*

TABLE OF CHANGES

Revision of Document	Author	Date	Description of changes
1.0	Mastronardi F.	03/08/10	First release
1.1	Mastronardi F.	17/05/11	First review
1.2	Statuti A.	30/06/11	Second review
1.3	Brogi D.	06/07/11	Third review

KEEP THESE INSTRUCTIONS!

IMPORTANT SAFETY INSTRUCTIONS

HOW TO USE THIS MANUAL

This manual contains important instructions regarding safety and operation, which must be understood and carefully followed during the installation and maintenance of the equipment.
In order to reduce the risk of electric shock and to be sure that the equipment is correctly installed and ready to operate, special safety symbols are used in this manual to highlight potential safety risks or useful information. The symbols are the following:

WARNING: Paragraphs marked by this symbol contain actions and instructions which must be understood and followed carefully to avoid potential harm to people.

NOTE: Paragraphs marked by this symbol contain actions and instructions which must be understood and followed carefully to avoid damage and malfunctions to equipment.

The equipment has various labels; those with a yellow background regard the safety devices provided.
Make sure to have read and thoroughly understood the labels before installing the equipment.
The symbols used are as follows:

	System earth conductor (grid protection earth, PE)
	Alternating Current (AC) Value
	Direct Current (DC) Value
	Phase
	Grounding (ground)
	Caution, hot surface
	Danger, risk of electric shock. Time to discharge stored energy: 5 minutes.

USEFUL INFORMATION AND SAFETY REGULATIONS

FOREWORD

- The installation of AURORA inverters must be performed in compliance with national and local regulations.
- The AURORA inverter has no spare parts.
  For all kinds of maintenance or repair, please contact the authorized repair centre closest to you. Please contact the retailer in order to find out the location of the closest service point.
- It is strongly recommended to read all the instructions contained in this manual, and to observe the symbols displayed in the individual paragraphs before installing or using the equipment.
- Connection to the distribution grid must only occur after having received approval from the Authority or Body in charge of the distribution of electric energy, as is required by the current national regulations, and must be carried out only and exclusively by qualified personnel.
- The entire solar panel must be covered with an opaque material before connecting it to the appliance, as high voltages can occur in the connecting cables generating conditions of serious hazard.

GENERAL

When the inverter is operating, there can be parts that are live, or non-isolated, and in some cases also moving or rotating, and, in addition, some surfaces may become hot.
Unauthorized removal of required protections, improper use, faulty installation or incorrect operation may cause serious damage to persons and things.
All operations concerning transport, installation, commissioning, and maintenance must be carried out by qualified and trained personnel only (all national standards for the prevention of accidents must be respected!!!).
According to this basic safety rules, qualified and trained individuals must be experts in the mounting, assembly, commissioning, and operation of the product, and must and have the necessary skills, qualifications and requisites to carry out their tasks.

ASSEMBLY

The devices must be assembled and cooled down in accordance with the specifications outlined in the relevant documentation.
In particular, during transportation and handling, the components must not be bent, and the isolation distances must not be changed. There must be no contact between electronic components and connection terminals.
Electrical components must not be mechanically damaged or destroyed (potential risk for health).

ELECTRICAL CONNECTION

When working with the live inverter, national regulations regarding accident prevention must be respected.
Electrical installation must be carried out in accordance with the relative regulations (e.g. conductor sections, fuses, PE connection).

OPERATION

The system in which the inverters are installed must be equipped with further control and protection devices, in accordance with the relative applicable safety standards, e.g. compliance with technical equipment, accident-prevention regulations, etc. Calibration variations are possible through the use of the operational software. After having disconnected the inverter from the mains grid, the live parts and the electrical connections must not be touched for a while, as capacitors may still be charged. For this reason, all the related signs and marks present on the devices must observed. During operation, all covers and doors must be closed.

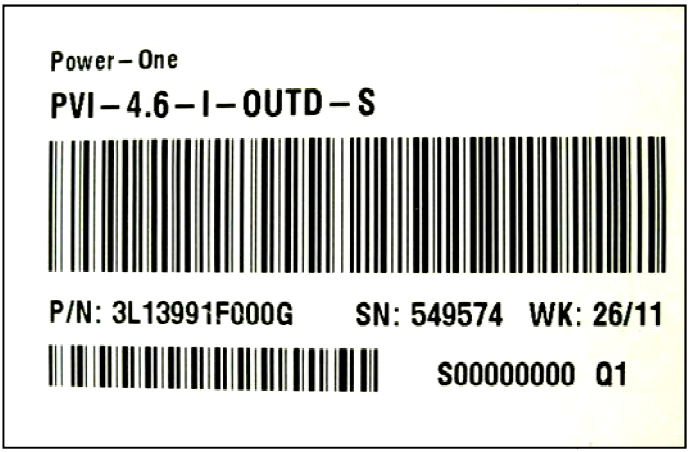
MAINTENANCE AND ASSISTANCE

The manufacturer's documentation must be observed.

KEEP ALL DOCUMENTATION IN A SAFE PLACE!

PVI-3.8-I-OUTD
PVI-3.8-I-OUTD-S
PVI-4.6-I-OUTD
PVI-4.6-I-OUTD-S

This documentation is only valid for the aforementioned inverter versions



Product name plate (PVI-4.6-I-OUTD-S)

The name plate affixed to the inverter contains the following information:

1) Manufacturer code
2) Model code
3) Serial number
4) Week/Year of production

CONTENTS:

1 INTRODUCTION

This document is a technical description of the AURORA photovoltaic inverter; the aim of the document is to provide the installer and user with the necessary information regarding the installation, operation and use of AURORA photovoltaic inverters.

1.1 PHOTOVOLTAIC ENERGY

In the energy transformation process, industrial companies (the greatest energy consumers) have for many years now, been experimenting with ways of saving energy and lowering pollutant emissions through the prudent and rational consumption of known resources, and have been searching for new forms of clean and inexhaustible energy.
Renewable energy sources provide a fundamental contribution to solving the problem. In this context, the exploitation of solar energy to generate electrical energy (photovoltaic) is becoming increasingly more important across the world.
Photovoltaic energy is a great advantage in terms of environmental protection as the solar radiation that we receive from the sun is directly transferred into electrical energy without involving any form of combustion and without producing waste products which would pollute the environment.

2 DESCRIPTION OF THE SYSTEM

AURORA is an inverter which is capable of feeding the power supply distribution grid with energy obtained from photovoltaic panels.
The photovoltaic panels transform energy radiated by the sun into electrical energy in the form of direct current, or DC (through a photovoltaic field, also known as a PV generator); to feed the distribution grid, however, and in order to make energy available for use, it is necessary to transform it into alternating current, or AC. This conversion, known as DC-AC conversion, is carried out in an efficient way by the AURORA inverters, without rotating elements, only using static electronic devices.
When used in parallel with the distribution grid, the alternating current output from the inverter flows directly into the domestic circuit, which is in turn connected to the public distribution grid.
The solar power system supplies energy to all that which is connected to it: from lighting to all the different domestic appliances, etc.
In the event that the energy supplied from the photovoltaic system is lower than required, the quantity of energy necessary to guarantee the normal operation of connected appliances will be taken from the public distribution grid. If the opposite occurs, that is excess energy is produced, it is sent directly into the public grid, thus becoming available to other users.
In accordance with local and National regulations, the Energy product can be sold to the distribution grid, or credited against future consumption, thus producing energy savings.

Available versions

PVI-3.8-I-OUTD
PVI-3.8-I-OUTD-S
PVI-4.6-I-OUTD
PVI-4.6-I-OUTD-S

The models whose code ends in -S are supplied with an integrated DC switch 600 V, 25A as shown in Fig. 1.

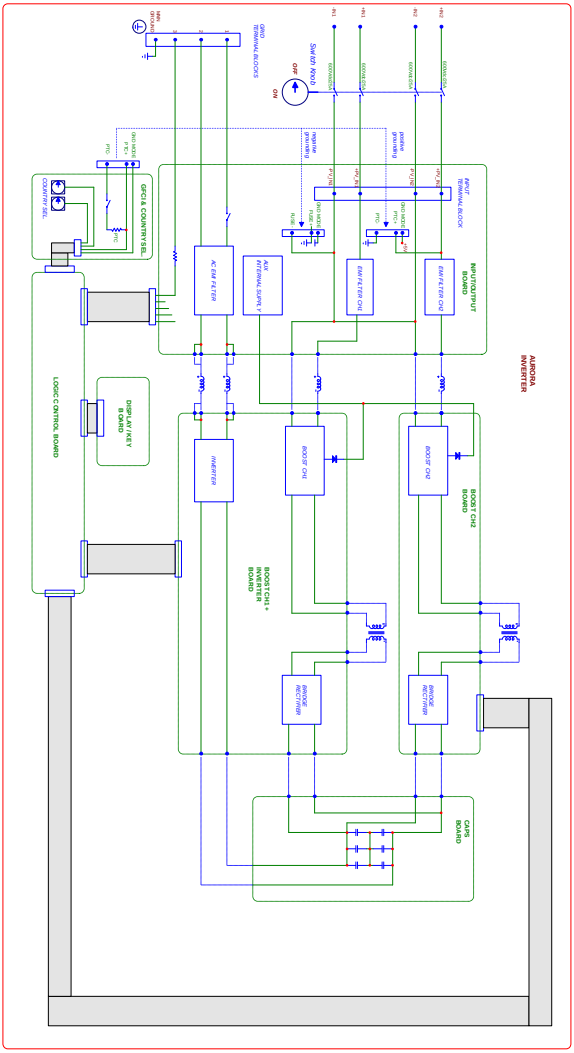


Fig. 1 - Block diagram of inverter without integrated DC switch

The models whose code does not end in -S are supplied without the 600V integrated switch.

2.1 Fundamental elements of a photovoltaic system: “STRINGS” and “ARRAYS”

In order to significantly reduce the costs of installing the photovoltaic system, costs linked especially to the wiring problem of the inverter DC side, and to the subsequent distribution on the AC side, the STRING technology was developed.
A photovoltaic panel is composed of many photovoltaic cells which are fixed onto the same supporting base. A STRING is composed of a certain number of panels, connected in series. An ARRAY is composed of one or more strings connected in parallel.
Photovoltaic systems of a certain size can be composed of more than one array, connected to one or more AURORA inverters.
By maximizing the number of panels inserted into each string, it is possible to reduce the cost and complexity of the plant connection system.

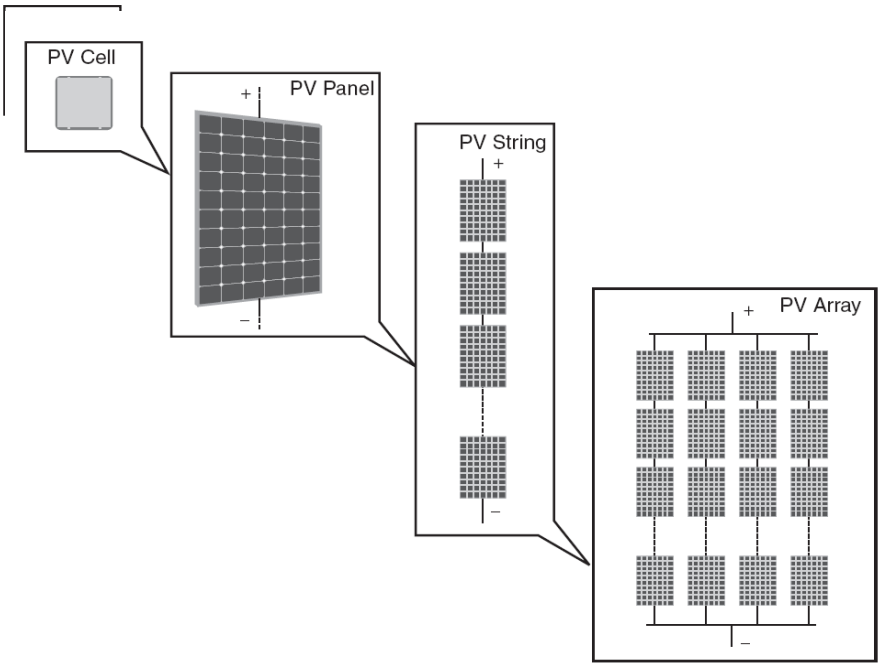


Fig. 2 Array composition

WARNING: To prevent damage to equipment, the string voltage must never exceed 520 Vdc. Due to the negative thermal coefficient of the open circuit voltage of the photovoltaic module, maximum voltage is obtained in conditions of minimum ambient temperature. It is advised to check the configuration of the photovoltaic generator by means of the Aurora Designer dimensioning software.

NOTE: A minimum Vstart input voltage of 200 Vdc (voltage can be set from the control panel within the range of 120 Vdc to 350 Vdc) is required in order to start the Aurora inverter grid connection sequence. Once connected, the inverter will transfer the maximum available power to the grid, for any Vdc input voltage value within the range between 70% of the value set for Vstart, and 470V. The power transferred for each array is also limited by the maximum manageable current (see paragraph below) (**Error! Reference source not found.** and **Error! Reference source not found.** show the limits for which maximum power is transferred).

The current of each array must also fall within the limits of the inverter. For the AURORA inverters, the maximum current coming from each input can be 14Adc for PVI-4.6-I-OUTD models, or 12.5 A for PVI-3.8-I-OUTD models.
In the event that the photovoltaic system exceeds the capacity of a single inverter, other AURORA inverters can be added to the system. Each of these inverters will be connected to an adequate section of the photovoltaic field on the DC side, and will be connected to the distribution grid on the AC side.
Every AURORA inverter will work independently from the others, and, from its section of photovoltaic panel, will supply the grid with the maximum available power.
Decisions regarding the structuring of a photovoltaic system depend on a certain number of factors and considerations, including the type of panels, the availability of space, the future location of the plant, long-term energy production targets, etc.
On the Power-One website (www.power-one.com) a configuration program is available to help you dimensioning your photovoltaic system (Aurora Designer).

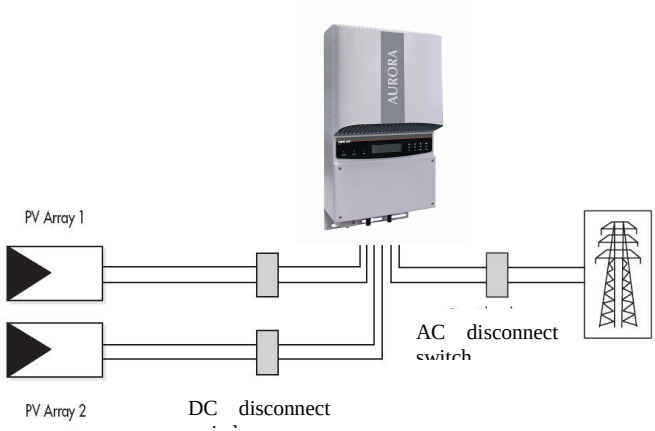


Fig. 3 - Simplified diagram of a photovoltaic system

2.2 Data transmission and monitoring

If more than one inverter is used, they may be monitored, even remotely, by using an advanced communication system which is based on the RS-485 serial interface. The Aurora Easy-Control system is also available as an additional form of monitoring, and allows for the remote monitoring of the system via the Internet or digital GPRS modem. Furthermore, a system of radio monitoring is also available as an option (PVI-Desktop + PVI-Radio module) to obtain a remote data display terminal, connected wirelessly.

2.3 Technical description of the AURORA inverters

Fig. 1 shows the block diagram of an AURORA inverter. The main blocks are the input DC-DC converters (known as “boosters”) and the output inverter. Both the DC-DC converters and the output inverter work at a high switching frequency to enable a compact design and a relatively low weight.
This version of inverter has a high frequency transformer, i.e. a transformer with galvanic isolation between input and output. The high frequency transformer allow galvanic isolation between the primary (DC side) and the secondary (AC side), maintaining very high performance in terms of energy yield and export. The AURORA inverters are equipped with all of the protections necessary for a safe operation, in compliance with the applicable regulations as described in the paragraph on protective devices.

The block diagram shows the PVI-3.8/4.6-I-OUTD model with two independent converters on DC-DC input. Each of these converters is dedicated to a separate array with an independent Maximum Power Point Tracking (MPPT) control. This means that the two arrays can be installed in different positions, facing in different directions. Each array is controlled by an MPPT control circuit.
Due to the size and high efficiency of the AURORA inverters and the thermal dissipation system, operation at maximum power in a wide range of ambient temperatures is guaranteed.
The inverter is controlled by two independent DSPs (Digital Signal Processors) and by a central microprocessor.
Connection to the power supply grid is thus controlled by two independent controllers, in full compliance with the current regulations for electrical power supply and its safety.
The AURORA inverter operating system communicates with related components in order to carry out data analysis.
All of this ensures the optimal operation of the entire system and a high yield in all isolation and load conditions, always fully respecting the relevant directives, laws and regulations.

2.4 Protections

2.4.1 Anti-Islanding

In the event of a failure in the local distribution grid due to the power supply provider, or if the machine is shut down for maintenance operations, the inverter must be physically disconnected in a safe manner, in order to guarantee the protection of those working on the grid, all in full compliance with the applicable national standards and laws. In order to avoid any islanding operations, the inverter is equipped with an automatic disconnection system, a protection known as “Anti-Islanding”.
The PVI-3.8/4.6-I-OUTD model is equipped with an advanced anti-islanding protection system, certified according to the following directives:

- Guide for connection to the ENEL low tension distribution grid
- VDE V 0126-1-1
- Royal Decree RD1663/2000 of Spain
- UK G83/1

2.4.2 Ground fault/RCD protection

WARNING: In some cases, national and local regulations make it obligatory to connect one of the DC input terminals to the system ground. Carefully refer the national standard in order to ground the inverter input correctly.

A specific connector allows connecting one and only one of the two DC input terminals (positive or negative) to the ground. A sophisticated ground protection circuit constantly monitors the ground connection, deactivates the inverter in the event that a ground fault is detected, and indicates the ground fault condition through a red LED located on the front panel. The AURORA inverter is equipped with terminals for the system ground conductors.
For further information about the grounding of terminals and protections, refer to section 3.4.9

NOTE: For further details about disconnecting the AURORA inverters or about the causes of malfunction, refer to paragraphs 0

Protections against ground faults comply with the following directives:

- Guide for connection to the ENEL low tension distribution grid
- VDE V 0126-1-1
- Royal Decree RD1663/2000 of Spain
- UK G83/1

2.4.3 Additional protective devices

The AURORA inverters are equipped with additional protections in order to ensure its safe operation under any circumstances. These protections include:

- continual monitoring of the grid voltage to guarantee that the voltage and frequency values remain within the operational limits;
- internal temperature control in order to limit power automatically, should it be necessary to ensure that the unit does not overheat (heat sink temperature ≤70°C [158°F]).

The numerous control devices create a redundant structure, ensuring the absolute safety of its operation.

3 INSTALLATION

WARNING: the electrical installation of the AURORA inverters must be performed in compliance with the applicable local and national standards and laws.

WARNING: connecting the AURORA inverters to the power supply distribution grid may only occur after having received authorization by the utility operating that grid.

3.1 Package inspection

NOTE: The distributor delivered your AURORA inverter to the carrier safely packaged, and in perfect condition. By accepting the package, the carrier assumes responsibility for its delivery. Despite careful handling by the carrier, both the packaging and its contents may have been damaged during transport.

The client is invited to perform the following checks:

- To examine the shipping container in order to check for visible damage, holes, cracking, or any other sign of possible damage to its contents;
- To describe any damage or missing parts on the delivery documents, and to obtain the carrier's full name and signature;
- To open the shipping container and examine its contents to check for any internal damage. When unpacking, make sure not to discard any equipment, components, or manuals. In the event that some form of damage is detected, contact the delivery carrier to determine the appropriate course of action. As the carrier may request an inspection, it is important to keep all shipping material for the inspector!
- Should the inspection detect damage to the product, please contact your local supplier or authorized distributor. They will determine whether the equipment must be returned for repair, and will provide the relevant instructions for doing so;
- It is the client's responsibility to file a complaint with the carrier. Failure to do so may result in the loss of all warranty service rights for any reported damage;
- Keep original shipping package in case the device has to be returned for repair.

3.2 Inspecting the package contents

Description	Quantity (No.)
AURORA Inverter	1
Bag containing: 4 screws 6.3x70, 4 SX10 anchors, Torx20 screwdriver, 1 screw 6x10, 5 washers d. 18, 2 counterparts for signal connectors (3 poles), 2 counterparts for signal connectors (8 poles)	1
Bracket for wall mounting	1
Copies of this manual	1
Certificate of warranty	1
CD-ROM with communication software	1

3.3 Selecting the location for installation

The inverter must be installed in a location chosen according to the following considerations:

- The inverter must be placed at a height from ground level, so that the display and status LEDs can be read easily.
- Choose a location which is protected from direct sunlight and is well-ventilated. Avoid locations where air is unable to circulate freely around the unit.
- Leave enough room around the unit to allow for easy installation and removal from the mounting surface.
- Hardware and software maintenance is carried out through the cover on the front of the inverter. It is thus necessary to have easy access to this side, if you do not wish to remove the unit from its mounting surface.

The figure below indicates minimum clearances that must be maintained around the inverter:

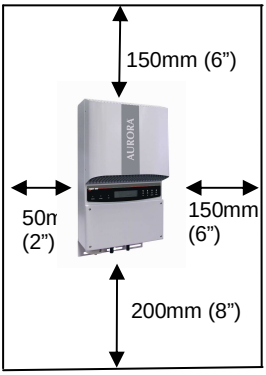


Fig. 4 - Installation location - Minimum clearances around the inverter

Fig. 5 - Recommended installation of Aurora inverters

NOTE: Although titled mounting is possible (see Fig. 6), please note that this may reduce performance (Derating), due to a reduction in heat dissipation.

WARNING: During operation, the unit surface may become very hot. To avoid burns, DO NOT touch the surface.

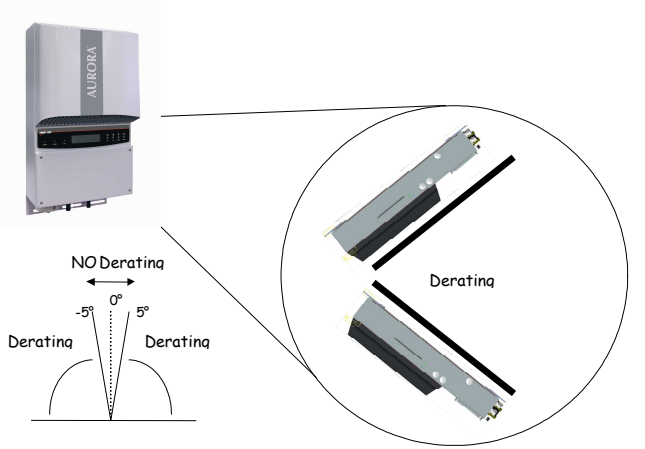


Fig. 6 - Titled mounting

AURORA must be mounted vertically. Follow the information contained in the following paragraphs in order to mount the device correctly.

NOTE. It is recommended to install AURORA away from direct sunlight and heat sources, including heat generated by other AURORA inverters (see Fig. 5)

When the ambient temperature exceeds 50°C for PVI-4.6-I-OUTD models, and 60°C for PVI-3.8-I-OUTD models, the inverter will self-derate the output power.

In order to avoid overheating, always ensure that the airflow around Aurora is not blocked.

3.3.1 Wall mounting

Included in the shipping package is a kit containing 4 steel screws 6.3x70 (with 4 M6 washers) and 4 SX10 anchors, necessary for attaching the metal bracket to a concrete wall. Screws and anchors can be inserted into the 3 holes on the metal bracket (Part. B), and then into the hole on the bottom of the inverter.

WARNING: The bracket must be attached to the wall vertically, the side with the hook (Part. C) must be facing upwards, while the side with the PEM M6 (Part. G) must be facing downwards.

NOTE: If the device is to be mounted onto a concrete wall, holes must be created of diameter 10mm and depth 75mm.

NOTE: When the device is installed on walls of materials other than concrete, suitable screws and anchors should be used. Power-One recommends always using stainless steel screws.

Attach the inverter to the hook (Part. C) present on the upper part of the bracket by using the metal fin, fixed onto the upper part of the rear of the inverter. This metal fin has a point (Part. D) in correspondence to the fixing hook of the wall-mounting bracket (Part. C).
Once the upper part of the inverter has been attached, fix the lower part to the PEM M6 present on the bracket, by using the special slot on the lower flange of the inverter (Part. H).

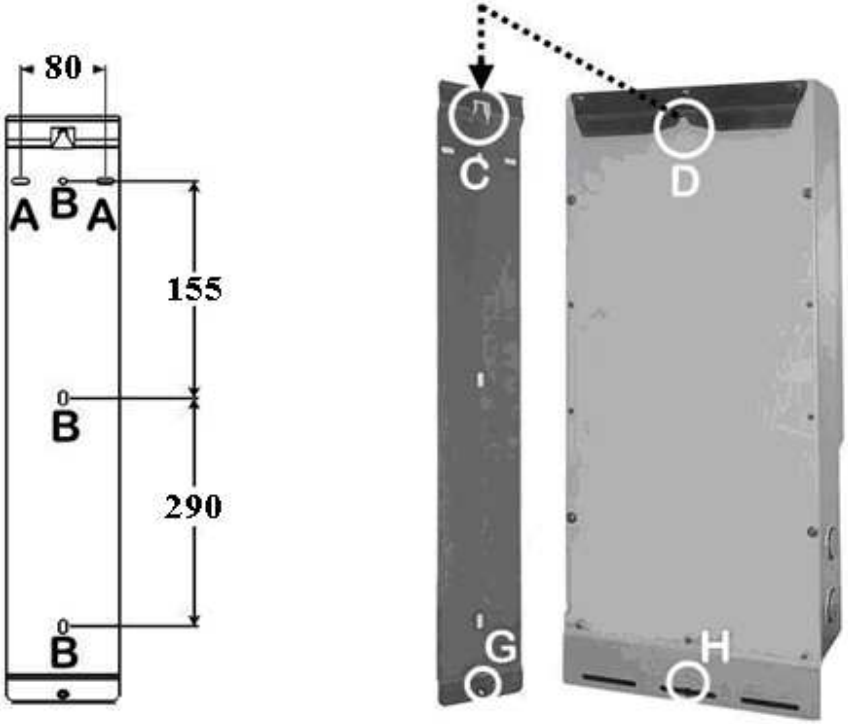


Fig. 7 – Wall mounting

3.4 Preliminary operations for electrical connection

WARNING: The electrical connection must only be made after the inverter has been firmly fixed to the wall.

WARNING: The connection from the inverter to the power supply distribution grid must be performed exclusively by qualified personnel, and only after authorisation has been received from the power supply provider managing the distribution grid.

WARNING: For details regarding each individual operation, it is necessary to read and follow the instructions in this chapter (and sub-chapters), and all safety warnings. Read the instructions carefully and follow them step-by-step. Any operation which does not conform to what follows may cause hazardous conditions for the operator/installer, and can cause damage to the equipment.

WARNING: When designing the system, always respect the voltage and current nominal ratings, as indicated in chapter 8 (Technical Specifications). The following, in particular, must be kept in mind when designing the photovoltaic field:

- Maximum DC input voltage to each of the two MPPT circuits: 520 Vdc.
- Maximum DC input current to each of the two MPPT circuits: 14Adc (PVI-4.6-I-OUTD), and 12.5Adc (PVI-3.8-I-OUTD).

WARNING: Check the national regulations and local standards, so that electrical installation complies with them.

In accordance with the assembly diagram, a main isolator, comprised of an automatic magnetothermic switch should be inserted between the inverter and the distribution grid, on the AC output side. The characteristics of the main isolator or automatic switch are 20A 230V for PVI-3.8-I-OUTD, and 25A 230V for PVI-4.6-I-OUTD.

3.4.1 Procedure of CONNECTION / DISCONNECTION

WARNING: It is advised to carefully follow the steps of this procedure in order to avoid possible damage to property and/or persons and damage to the equipment. The AURORA inverters have very high operational voltages which can be extremely dangerous if all precautions are not observed.

WARNING: The following operations must always be carried out when accessing the interior parts of the inverter in order to avoid injury to people and damage to property.

STEP 1 If the inverter is connected to the power supply grid, disconnect it by opening the switch indicated as Part. “D” in Fig. 8

STEP 2 Carefully cover the photovoltaic panels with an opaque material, or perform the following operations at night. Ensure that the photovoltaic field cannot provide power before proceeding with the installation.

STEP 3 Disconnect the DC part by opening the integrated disconnect switch (models with the -S suffix) or the external disconnect switch.

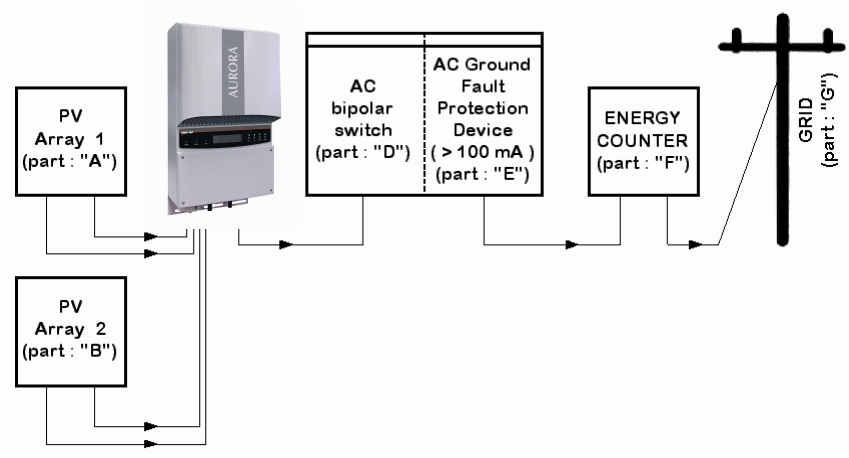


Fig. 8 - Electrical connection diagram

WARNING: When selecting cables, several factors have to be considered: nominal voltage, isolation rating, maximum operating temperatures, current rating, and flammability rating, in accordance with the national regulations of the country of installation. Procedure for accessing the internal terminal blocks by removing the front cover

3.4.2 Procedure for accessing the internal terminal blocks by removing the front cover

WARNING: Before removing the front cover, ensure that the AURORA inverter has been disconnected from both the AC and DC sides for at least 5 minutes, in order to allow for the internal capacitors to discharge, and thus to avoid the risk of electrocution.

To remove the front cover, loosen the 4 screws shown in Fig. 9 using the Torx screwdriver provided.

Fig. 9 - Front cover of the inverter

Once the cover has been reassembled, ensure to tighten the screws at a torque of at least 1.5Nm (13.2 in-lbs) for ensuring a watertight seal.

3.4.3 AC and DC wire selection

The following tables will help the installer to select AC and DC wires

PVI-3.8-I-OUTD			
		AWG 167°F (75°C)	AWG 194°F (90°C)
DC input wiring	PVI-3.8-I-OUTD	8-6	10-6
Ground	PVI-3.8-I-OUTD	4	4
AC output wiring	PVI-3.8-I-OUTD	8-6	10-6
Main ground	PVI-3.8-I-OUTD	6	6

PVI-4.6-I-OUTD			
		AWG 167°F (75°C)	AWG 194°F (90°C)
DC input wiring	PVI-4.6-I-OUTD	8-6	10-6
Ground	PVI-4.6-I-OUTD	4	4
AC output wiring	PVI-4.6-I-OUTD	8-6	8-6
Main ground	PVI-4.6-I-OUTD	6	6

3.4.4 Installation of the AURORA inverter.

WARNING: The maximum DC input current to each of the two MPPT circuits should not exceed 14Adc (PVI-4.6-I-OUTD), and 12.5Adc (PVI-3.8-I-OUTD), under any conditions.

WARNING: Follow the procedure step-by-step in order to avoid damage to things and injury to people.

Step 1: Disconnect the inverter from the AC grid by turning off the AC switch, "part D" in Fig. 8. Also turn off the DC part by using the DC switch (integrated in -S models or external).

Step 2: Remove the inverter front cover as described in paragraph 0. Connect the DC cables to the inverter, carefully checking the correct polarity. For possible connection types, refer to 3.4.5.

Step 3: Connect the AC cables to the terminal block, following the instructions laid out in paragraph 3.4.6.

Step 4 (optional): Connect the signal cables to the specific terminal block. Replace one of the capped holes present on the bottom of the inverter with a cable gland (supplied) and use it to pass through the wires..

Step 5: Remove the cover from the photovoltaic panels

WARNING: Verify the polarity and the no-load voltage on the inverter terminal block to ensure that the connection has been made correctly.

If the parameters fall within the range defined by the inverter's technical specifications, reclose the inverter by replacing the cover and tightening the screws as described in paragraph 0, then and proceed to section 4.

3.4.5 Possible configurations of input channels

WARNING: Before carrying out any operation, follow the connection/disconnection procedure detailed in paragraph 3.4.1.

The inverter models referred to in this manual are supplied with two input channels, "1" and "2" (thus with a double maximum power point tracker, MPPT) which are configured in parallel. They can however be configured independently by following some simple operations during the installation phase.
To each individual channel, strings of photovoltaic modules which have the same type and number of panels must be connected in series. Moreover, they must require the same installation conditions (orientation and inclination).
When the two input channels are configured in parallel, they must respect the aforementioned requirements with the benefit of being able to exploit full power from the inverter in a single channel.
The double MPPT structure allows two photovoltaic generators to be run independently (one for each input channel), which can differ in terms of installation conditions, and the type and number of photovoltaic modules connected in series.
In order for the two MPPT to be used independently, the photovoltaic generator connected to each of the inputs MUST have current and power values which are lower than the power limit of the individual input channel.

The two input channels (MPPT) are configured in parallel as the default setting.
All of the input parameters which must be respected to ensure the correct operation of the inverter are reported in the "Technical characteristics" paragraph.
After having chosen the type of connection, follow the instructions in paragraph 3.4.4

3.4.5.1 Connection with independent channels

WARNING: Before carrying out any operation, follow the connection/disconnection procedure detailed in paragraph 3.4.1.

To use this configuration, the input current to each channel must be less than 14Adc (PVI-4.6-I-OUTD) or 12.5Adc (PVI-3.8-I-OUTD) and the input power to each channel must be less than 3kW.

In order to configure Aurora with independent channels, remove the jumpers between the positive and negative terminals in
Fig. 10, and move the selector switch in
Fig. 11 to the "IND" position.

3.4.5.2 Parallel connection of channels

WARNING: Before carrying out any operation, follow the connection/disconnection procedure detailed in paragraph 3.4.1.

Use this configuration when the input current to one of the channels is greater than 14Adc (PVI-4.6-I-OUTD) or 12.5Adc (PVI-3.8-I-OUTD), or when the input power to one of the channels is greater than 3kW.

Parallel configuration is the factory setting therefore, it is not necessary to change the connections.

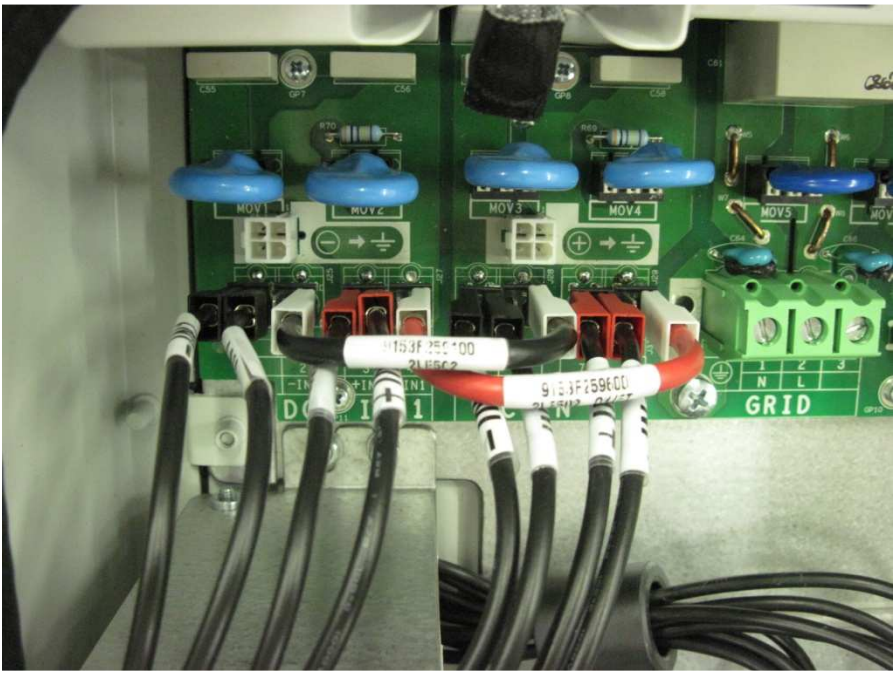


Fig. 10 – Parallel connection of channels

Check that the jumpers are inserted and that the selector switch in Fig. 11 is in the "PAR" position.

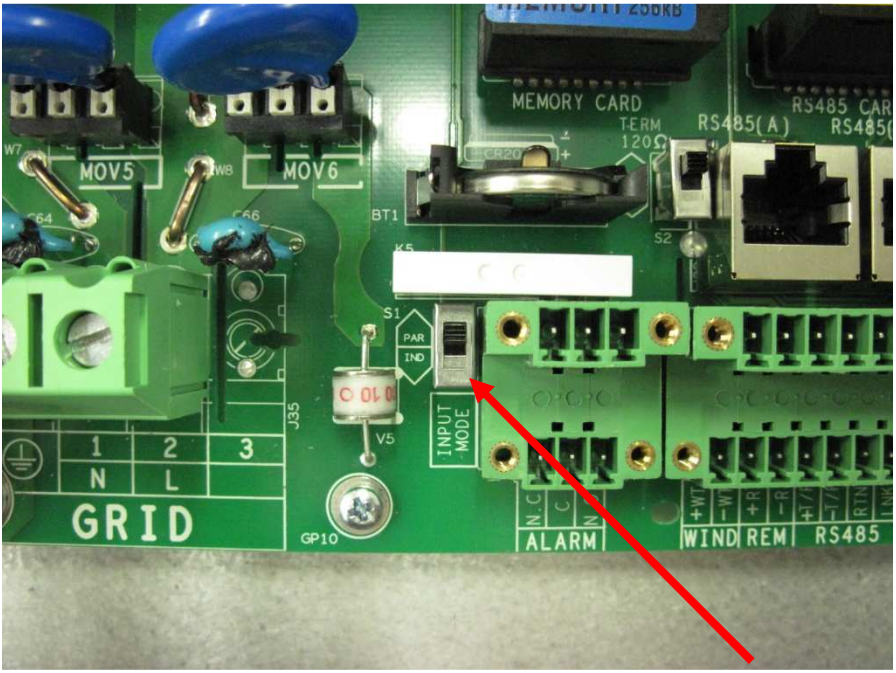


Fig. 11 – Parallel/independent configuration switch

3.4.6 Connection to the AC grid

WARNING: Before carrying out any operation, follow the connection/disconnection procedure detailed in paragraph 3.4.1.

Step 1: Remove the front cover of the inverter as shown in section 0.

Step 2: Connect the AC cables from the external disconnector to the internal inverter terminal box indicated by the serigraphy “GRID”.

Step 3: Install the cable gland (supplied) onto the dedicated hole located on the bottom of the inverter and use it to pass through the AC cables.

Step 4: Connect the 3 AC conductors to the inverter terminal box, following the serigraphy.

- Terminal ⏚ for protective earth PE (the screw located next to the symbol can also be used for connecting to the earth conductor)
- terminal 1 for Neutral N,
- terminal 2 Line L,

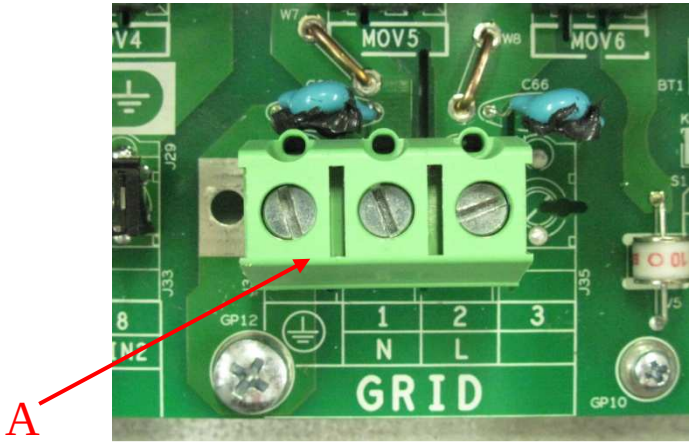


Fig. 12 - Terminal Block for connection to AC conductors

3.4.7 Connection of alarm cables and RS485 (optional)

WARNING: Before carrying out any operation, follow the connection/disconnection procedure detailed in paragraph 3.4.1.

Step 1: Remove the front cover of the inverter as shown in section 0.

Step 2: Replace one of the holes present on the bottom of the inverter with a cable gland (supplied) and use it to pass though the alarm relay or signal cables.

Step 3: Connect the wires by following the serigraphy of the signal connector.

3.4.8 Selection of grid standard

WARNING: Before carrying out any operation, follow the connection/disconnection procedure detailed in paragraph 3.4.1.

The inverter is provided with two rotary selectors (**Error! Reference source not found.**) which allow installers to choose which grid standard they wish to apply. The unit is delivered with the selector switches set in the '0''0' position (default setting). To allow the Aurora photovoltaic inverter to operate regularly, installers must select the grid standard in accordance with the national regulations,

To access the selector switches, remove the front cover as shown in paragraph 0.

NOTE: The '0''0' default position does not allow connection to the power supply grid.

Select the standard based on the following table:

Left selector switch	Right selector switch	Grid standard	Language
0	0	Standard de-selected	English
0	1	VDE 0126	German
0	2	UL 1741 @208V	English
0	3	UL 1741 @240V	English
0	4	UL 1741 @277V	English
0	5	ENEL	Italian
8	8	Reserved	
F	F	Reserved	

(*) The table above is the basic table; further additions can be added when new standards become available

Once the standard has been chosen, a meter will begin to scan the connection to the grid for 24 hours. Before 24 hours expire, the selected standard can still be changed. Once the 24 hours have passed, the Power-One assistance center would have to send an Authorization Key to unblock the inverter, and allow further changes. Remaining time can be checked on the information menu

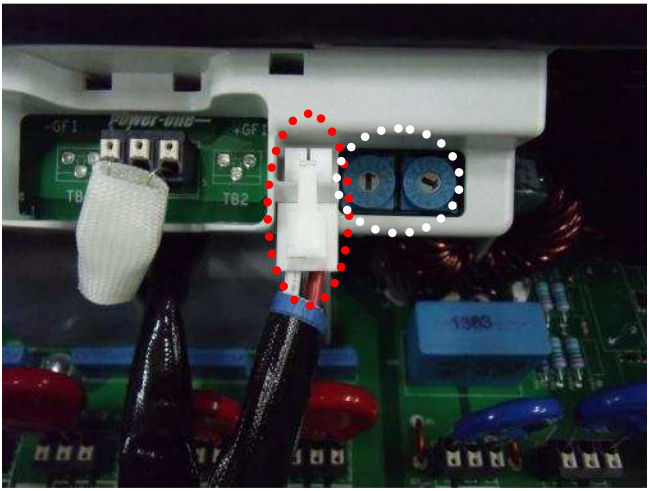


Fig. 13 - Selector switches for grid standard and grounding connector positioner

3.4.9 Grounding of DC inputs

WARNING: Before carrying out any operation, follow the connection/disconnection procedure detailed in paragraph 3.4.1.

These inverter models are equipped with a special connector for grounding one of the input terminals.
By positioning of this connection, it is possible to choose which terminal to connect to the ground. **Error! Reference source not found.** shows the cables and the connectors to which they must be connected in order to make the grounding effective.

NOTE: The Aurora inverters are delivered with the grounding connection disconnected. The connection is to be chosen during the installation process.

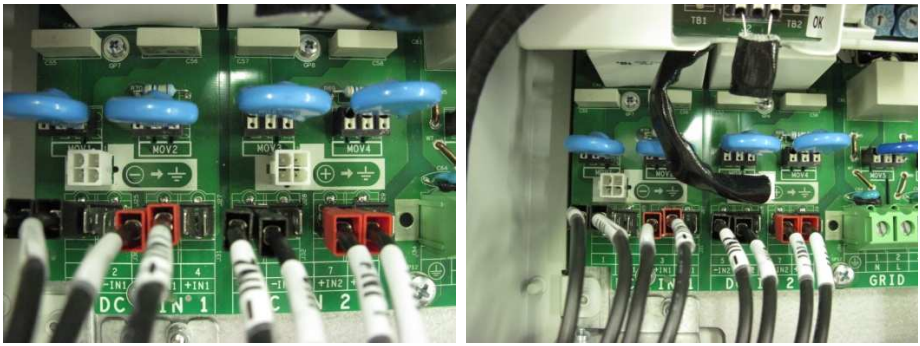


Fig. 14 - Connectors for grounding inputs

It is possible to make the connection in two ways:

a) Grounding of the negative DC terminal.
b) Grounding of the positive DC terminal.

WARNING: Option b) is only available when the inputs are configured in parallel. YOU MUST NOT use option b) if the inputs are configured independently.

Should you not wish to connect either of the two input terminals directly to the ground, you can disconnect the connector and store it within the dedicated housing next to the grid standard selector switches, see Fig. 13.

NOTE: Under these conditions, neither of the input terminals is completely floating, but each is connected to the ground with an impedance of around 1.5 Mohm.

WARNING: Depending on the grid standard chosen (see section 3.4.8), the inverter will be able to recognize any grounding which does not respond to the applicable regulations and an error message will appear on the display.

3.5 CR2032 Lithium Battery Replacement

WARNING: Before carrying out any operation, follow the connection/disconnection procedure detailed in paragraph 3.4.1.

Inside Aurora, there is a CR2032 lithium battery. When the battery is at its end-of-life, a message will be shown on the display indicating the battery state.
The battery can easily be seen once the front panel has been removed (see Fig. 15).
The component cannot be assembled vertically to its container, but it must be inserted from the side (Side A), at an angle of around 30°. The component will rotate inside the battery port until it seats in the right position.

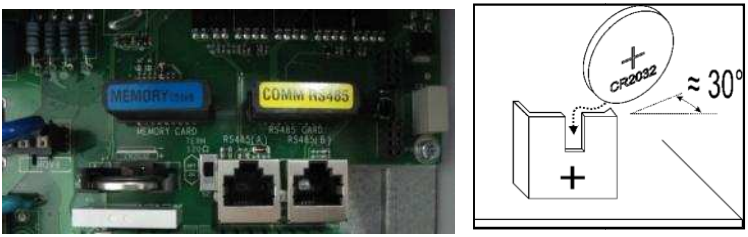


Fig. 15 – Lithium battery replacement

WARNING: The battery must be replaced by qualified personnel only.

3.6 Replacement of the memory

WARNING: Before carrying out any operation, follow the connection/disconnection procedure detailed in paragraph 3.4.1.

All historical data relative to the system energy production are stored in this memory. If the inverter must be replaced, the memory can simply be removed from the old unit, and reinserted into the new one. By so doing, you can continue to save present and future daily data on this memory, and avoid losing the data already stored in it. See **Error! Reference source not found.**

Fig. 16 - Inverter memory

WARNING: This component must be replaced by qualified personnel only.

3.7 Replacement of the RS485 communication board

WARNING: Before carrying out any operation, follow the connection/disconnection procedure detailed in paragraph 3.4.1.

It is possible to replace the RS485 communication board.

Fig. 17 - RS485 Board

WARNING: This component must be replaced by qualified personnel only.

4 COMMISSIONING AND SWITCHING OFF THE INVERTER

WARNING: do not place any items of any sort on top of AURORA during operation.

WARNING: do not touch the heart sink when the inverter is operating as some parts may be extremely hot.

4.1 Start-up procedure

To start the inverter and interact with the display using the keypad, a minimum voltage of 130Vdc is necessary on at least one of the DC INPUTS.

WARNING: The Aurora inverters are designed to be supplied by sources of limited current (solar panels). It is thus recommended not to use sources that may supply sudden peaks of current capable of damaging the circuitry (for example, batteries).

Should the DC source (panel) be unavailable, it is possible to force the start-up of the display for brief periods by supplying it from the grid (see paragraph 4.2).

Depending on the DC input voltage present, the inverter will behaves as follows:

a) When the inverter is switched off, it starts up as soon as an input voltage value of 130V is reached.

b) The inverter displays the message "Awaiting Sun" until the input voltage exceeds the set Vin start value (see paragraph 5.5.6.8).

c) When the Vin start value is exceeded, the inverter displays the message “Vac absent” if the grid is not connected, whereas if the grid is present the inverter connects to it.

d) The inverter will stay connected to the grid if the input voltage is between 70% of the set Vin start value and 520 Vdc. If the input voltage is outside this range, the inverter disconnects from the grid.

The procedure for commissioning AURORA is as follows:

1) Set the inverter integrated DC disconnector (for the photovoltaic panels) to the ON position

2) **NOTE**: The DC disconnector of the panels may or may not be integrated into the inverter, depending on the chosen model.

2) Set the external AC disconnector (related the grid) to the ON position.

   The two disconnectors can be closed in any order, without the need of giving priority to one over the other.

3) Once the two disconnectors are closed, the inverter starts the grid parameter control sequence. This operation will be indicated by the flashing of the green LED (which is labeled POWER and located on the display).
   This check may take from a minimum of 30 seconds to a maximum of some minutes, depending on the conditions of the grid itself. During the process, a sequence of three screens appears on the display:

   - Grid voltage value, and indication of status with respect to the values of the technical specifications, if within or outside of the range foreseen.

   - Grid frequency value, and indication of status with respect to the values of the technical specifications, if within or outside of the range.

4) Once the connection process has been completed, AURORA starts to operate, signaling its correct functioning by emitting a warning sound and by keeping the green LED continually on.

5) If the grid check does not give a positive result, the unit repeats the procedure again, until all the grid voltage parameters are within the range. During this phase, the green LED will be flashing.

4.2 Start-up using the side button

If DC voltage is not present but the AC grid is properly connected and you wish to start the inverter, press the side button shown in **Error! Reference source not found.** for more than 2 seconds. A beep indicates that the system has acknowledged the input given by pressing the button.
The inverter will remain switched on for 10 minutes, allowing for the monitoring of any type of value on the display (statistics, settings, etc.). The inverter will not connect itself to the grid until a valid and stable DC input voltage is present. When the inverter is started up under these conditions (with no DC), its consumption is less than 20W.

Fig. 18 – Button for starting-up the inverter from the grid

4.3 Shut-down procedure

The inverter can be shut down in three different ways:

1) Disconnect DC and the AC grid by disconnecting their disconnectors (in any order). The inverter will shut down after a few seconds, which are required in order to discharge the internal capacities.
2) Disconnect DC by disconnecting the relative disconnector, and wait for the set UV prot. Time (see paragraph 5.5.6.12).
3) Disconnect the grid by disconnecting its disconnector, with a DC input lower than 80 Vdc.

5 USER INTERFACE, MONITORING, AND DATA TRANSMISSION

5.1 User interface mode

Normally, the AURORA inverter operates automatically, and does not require any particular controls. When solar radiation is sufficient to generate power to be input into the grid (for example, at night), AURORA automatically disconnects itself, entering into stand-by mode.
The operating cycle is automatically resumed when solar radiation becomes sufficient. This will be indicated by the LEDs.
The AURORA inverter is capable of supplying operational information through the following instruments:

- Indicator lights (luminous LEDs)
- Operational data shown on the LCD display
- Data transmission on a dedicated serial RS-485 line. Data can be collected from a PC or data logger, equipped with an RS-485 port. If an RS-485 line is employed, it may be beneficial to use the RS485-USB converter, model number PVI-USB-RS485_232. Furthermore, it is possible to use the PVI-AEC-EVO data logger.

WARNING: the RS-485 cable must ensure a protection of at least 600V.

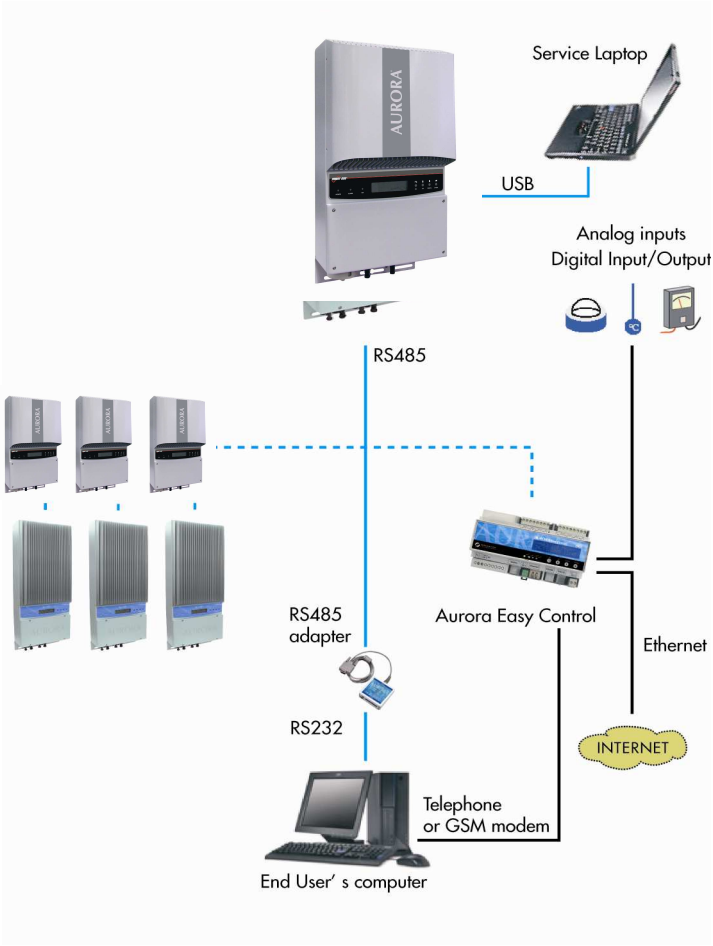


Fig. 19 - Data Transmission Options

5.2 Data types available

AURORA supplies two types of data which can be read through the display and/or through the appropriate interface software.

5.2.1 Real-time operational data

Real-time operational data can be transmitted on demand through the communication lines, and will not be internally registered inside the inverter. For transmitting data to a PC, the free AURORA Communicator software can be used. This software is included in the installation CD (please check the website www.power-one.com for the latest updated version).

The following data is available:

- Grid voltage
- Grid current
- Grid frequency
- Power transferred to the grid
- Voltage of photovoltaic array 1
- Current of photovoltaic array 1
- Voltage of photovoltaic array 2
- Current of photovoltaic array 2
- Temperature of internal semiconductors
- Serial number of Code
- Week of production
- Firmware revision code
- Daily energy
- System earth leakage current
- Total energy
- Partial energy
- Mean grid voltage
- Isolation resistance
- Leakage current to the ground
- Date, time
- Daily peak power
- Absolute peak power
- Input power

5.2.2 Data stored inside the inverter

AURORA stores the following data internally:

- Total meter of grid connection time
- Total meter of energy transferred to the grid
- Partial meter of energy (uses the same start time as the partial time meter)
- Daily energy meter
- Weekly energy meter
- Monthly energy meter
- Annual energy meter
- Energy meter over last 7 days
- Energy meter over last 30 days
- Energy meter over last 365 days
- Energy meter for a user-defined period
- Daily energy buffer produced over the last 366 days
- Buffer of last 100 fault signals with error code and time mark

All the meter data is shown on the LCD display and on the RS-485 interface; the daily energy and error buffers can only be viewed through the RS-485 interface.

5.3 LED indicators

At the side of the display, there are three LEDs. The first from the left (POWER) indicates the proper functioning of the inverter; the central LED (FAULT) indicates the presence of an anomaly; and the right-hand LED (GFI) indicates a ground fault.

1. The green LED “Power” indicates that AURORA is operating correctly.
   When the unit is undergoing commissioning, and the grid is being checked, this LED will be flashing. If a correct grid voltage is detected, the LED will stop flashing, and will emit a steady light, as long as solar radiation is sufficient to start up the unit. If not, the LED will continue to flash until solar radiation becomes strong enough to start up the inverter. During this phase, the LCD display will show the message "Awaiting sun..."
2. The yellow LED "FAULT” indicates that AURORA has detected a fault. The type of problem will be shown on the display.
3. The red LED “GFI” (ground fault) indicates that AURORA is detecting a ground fault in the DC side of the photovoltaic field. When a fault is detected, AURORA will immediately disconnect itself from the grid, and the relative error message will appear on the LCD display. AUORA will remain in this state until the operator presses the ESC key in order to restart the grid connection process. If AURORA does not re-connect itself to the grid, technical assistance must be called in order to identify and remove the cause of the system fault.

Fig. 20 - Location of buttons and LEDs

The following table shows all the possible combinations of LED activation, with reference to the operational state of AURORA.

Key:

■ **LED on**

◪ **LED flashing**

☒ **LED off**

□ **Any of the aforementioned conditions**

	LED STATUS	OPERATIONAL STATUS	NOTES
1	green: ☒ yellow: ☒ red: ☒	AURORA self-disconnection at night	Input voltage less than 90 Vdc for both inputs
2	green: ◪ yellow: ☒ red: ☒	AURORA initialization, loading settings and waiting for grid check	It is in a transition status needed for checking the operating conditions
3	green: ■ yellow: ☒ red: ☒	AURORA is transferring energy to the grid	The machine is operating normally (search for the maximum power point or constant voltage)
4	green: □ yellow: □ red: ■	Anomaly detected in the system isolation device	Leakage to the ground detected
5	green: ☒ yellow: ■ red: ☒	Anomaly – fault!!!	The fault may an internal or external anomaly, see the report on the LCD display

6	green: ☒ yellow: ◪ red: ☒	Installation phase: AURORA is disconnected from the grid.	During installation, it indicates the address setting phase for RS-485 communication
7	Green: ◪ yellow: ■ red: ☒	Disconnection from the grid	Indicates that the grid is missing

NOTE: In correspondence with each of the inverter states, signaled via the constant or intermittent lighting up of the relevant LED, a message identifying the operation which is being performed or the fault/defect detected will also be displayed on AURORA LCD display (see the following paragraphs).

V ☒
G ☒
R ☒

1) Night-time mode

AURORA is in its night-time shut-down phase; this happens when the input power is too low to feed the inverter.

V ◪
G ☒
R ☒

2) AURORA initialization and grid check

The machine is in its initialization phase. Input power is sufficient to feed the inverter. AURORA is checking that the conditions necessary for start-up have been satisfied (for example, input voltage value, isolation resistance value, etc.), and starts the grid check.

V ■
G ☒
R ☒

3) AURORA is feeding the grid

After having completed the series of autotests, the machine connects itself to the grid.
As previously mentioned, AURORA will automatically perform a search and analysis of the maximum power point (MPPT) of the photovoltaic field.

V ☐
G ☐
R ■

4) Ground isolation fault

AURORA indicates that the isolation resistance value is too low.
The problem may be linked to an isolation fault in the connection between the photovoltaic field inputs and the ground.

WARNING: it is extremely dangerous to attempt to correct the fault yourself. The instructions below must be followed very carefully. Please contact a specialist if you do not possess the experience or qualifications necessary to work safely on the system.

What to do after an isolation fault has been detected

When the red LED turns on, try to reset the fault indication by using the multifunctional ESC button at the side of the LCD display. If AURORA reconnects to the grid normally, the fault was due to temporary circumstances (for example, infiltration of humidity onto the panels due to condensation).It is recommended to allow a specialized technician to inspect the machine if the fault continues to occur. It is recommended to allow a specialized technician to inspect the machine if the fault continues to occur.
If AURORA does not reconnected to the grid, it is necessary to

put AURORA into a safe condition by isolating it on both the DC and AC sides and contacting an authorized centre in order to have the fault repaired.

V ☒
G ■
R ☒

5) Anomaly-Fault indication

Each time that AURORA's check system detects an anomaly or fault in the operation of the monitored system, the yellow LED lights up continually and a message indicating the type of problem detected will appear on the LCD display.

V ☒
G ◪
R ☒

6) Internal ventilation system anomaly

Indicates that the ventilation system is not woking correctly. This should not cause problems as the fan is only activated when high temperatures are combined with high output power.

V ◪
G ■
R ☒

7) Grid disconnection

When the system is functioning normally and a grid failure event occurs, the yellow LED will immediately light up with a steady light, and the green LED will flash.

5.4 Messages and error codes

The system status will be identified by message or error signals, shown on the LCD display.
The tables below summarized the two types of signals which may be displayed.

The MESSAGES indicate the current status of AURORA, they are not caused by faults and do not involve any action; the messages will disappear once normal conditions are re-established (See the W lines in the following table).

ALARMS indicate a possible fault in the equipment or connected parts. The signal will disappear once causes are removed, except in the case of ground isolation problems, for which qualified personnel will have to be called in order to have the system restored to normal operation. The appearance of an error signal generally involves some form of action by the installer of by the Power-One Service. The AURORA photovoltaic inverters will show on display much helpful information as possible to those performing the necessary maintenance on the equipment or system. See the E line in the following tables.

Message	Error warning	Error type	Description
Sun Low	W001	//	Input Voltage under threshold *Input voltage under threshold (in OFF status)*
Input OC	//	E001	Input Overcurrent
Input UV	W002	//	Input Undervoltage
Input OV	//	E002	Input Overvoltage
Int.Error	//	E003	No parameters *No parameters*
Bulk OV	//	E004	Bulk Overvoltage
Int.Error	//	E005	Internal Communication Error *Communication error in internal bus*
Out OC	//	E006	Output Overcurrent
Int. Error	//	E007	IGBT Sat
Sun Low	W011	//	Bulk Undervoltage
Int.Error	//	E009	Internal Error *Internal error*

Message	Error warning	Error type	Description
Grid Fail	W003	//	Grid Fail *Grid out of range*
Int.Error	//	E010	Bulk Low
Int.Error	//	E011	Ramp Fail
DC/DC Fail	//	E012	Internal error

Wrong Mode	//	E013	Wrong Input setting (Single instead of dual) *Wrong setting of inputs (single channel instead of dual)*
Over Temp.	//	E014	Overtemperature *Internal temperature too high*
Cap. Fault	//	E015	Bulk Capacitor Fail *Bulk capacitor failure*
Inv. Fail	//	E016	Internal error
Int.Error	//	E017	Internal error
Ground F.	//	E018	I leak fail *High leakage current or incorrect ground mode*
Int.Error	//	E019	Ileak Sensor fail *Leakage current error*
Int.Error	//	E020	Output relay self test fail *Output relay self test failed*
Int.Error	//	E021	Output relay self test fail *Output relay self test failed*
Int.Error	//	E022	Output relay self test timeout *Output relay self test failed*
Int.Error	//	E023	Dc-Injection Error
Int.Error	//	E024	Internal Error
Int.Error	//	E025	Riso Low (Log Only) *Isolation resistance low (log only)*
Int.Error	//	E026	Internal error
Int.Error	//	E031	Output relays fail *Output relays fault*
Int.Error	//	E032	Unbalanced output currents *Output currents unbalanced*

Fan Fail	W010	//	Fan Fail (No disconnection) *Fan failure (log only)*
Int.Error	//	E033	Under Temperature *Internal temperature too low*
IGBT not ready	//	E034	Internal Error
Remote OFF	//	E035	Remote Off
Int.Error	//	E036	Vout Avg *Average output voltage out of range*
Int.Error	W012	//	Clock Battery Low (No disconnection) *Clock battery low*
Int.Error	W013	//	Clock Failure (No disconnection) *Clock does not work*

5.5 LCD Display

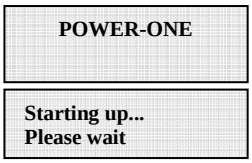
5.5.1 Connection of the system to the grid

The two-line LCD display is located on the front panel, and shows the following:

- ✓ The operating status of the inverter and statistical data;
- ✓ Service messages for the operator;
- ✓ Alarm and fault messages.

During regular operation, the display will cycle through available data. The screens change every 5 seconds, or can be changed manually by pressing the UP and DOWN keys (see Fig. 20).

These 2 screens are displayed at inverter start-up:



One of the following two screens may be displayed while waiting for the connection, depending on conditions:

While the system is checking the grid connection, the yellow LED next to the display will be lit up constantly and the green LED will be flashing;

When waiting for solar radiation ("Waiting sun"), the yellow LED will be off while the green LED will be flashing.

As soon as the "Vac absent" and "Awaiting sun" conditions have been successfully satisfied, the inverter will start the inverter connection procedure. Depending on the type of grounding, different controls will be performed and different screens shown.

If the system is grounded (one of the two poles is connected to the ground) the first screens will be as follows

GND ISO SELFTEST **RUN … Vgnd 130V**	**GND ISO SELFTEST** **OK Vgnd 130V**

If instead, the system is ungrounded (neither of the two poles is connected to the ground), the first screen will be as follows:

Control grid: **30 sec**

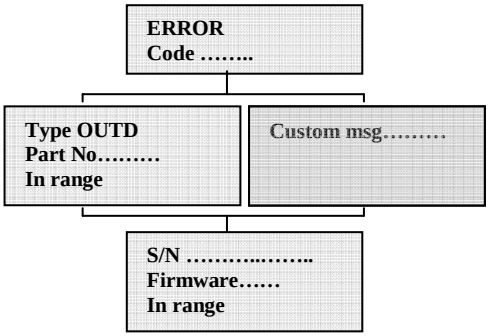
After the first control, the following screens will alternate between them

V grid 223.8 V **K**	**Fgrid 50.17 Hz** **OK**	**Connection** **.....**

The grid voltage and frequency values will be displayed along with information regarding whether they are inside or outside the range, until the connection is made
When connected, a beep will sound from the buzzer and from this point, the screens will show the measurements, as described in paragraph 5.5.3.

5.5.2 Error messages

After the connection has been established, if the inverter detects incorrect information in the test cycle, the system will interrupt this cycle, indicating the error code. Refer to the table in paragraph 5.4 for information on error codes.
To customize the display message, use the programming procedure described in chapter 5.5.6.14 “Alarm Message”.
Until the error has been solved, the system will continue to show the following cycle of screens:



Once the error has been rectified, the inverter resets all of the function in progress, restarting the connection (chapter 5.5.1, Connection of the system to the grid)

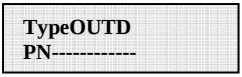
5.5.3 First phase - Electric parameter check

GENERAL QUESTIONS RELATING TO THE USE OF DISPLAY KEYS:
During regular operation, the display will cycle through available data. The screens change every 5 seconds or can be alternated manually by pressing the UP and DOWN keys (see Fig. 20).
In any case, to return to the previous menu, press the ESC key (see Fig. 20).

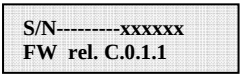
Fig. 21

Activation of cyclical scrolling is indicated by the 2 arrows in the top left-hand corner of the display (Fig. 21).
Scrolling can be blocked by pressing the ENTER key. A padlock symbol will appear (Fig. 21).

If the measures performed previously, in chapter .5.5.1, are found to give a positive result then the system will continue with other checks. The following screens repeat cyclically as described in the paragraph “GENERAL QUESTIONS REGARDING THE USE OF DISPLAY KEYS”.

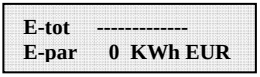


Type and p/n of the inverter

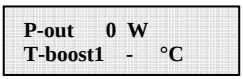


Indicates the serial number of the inverter and the firmware revision level

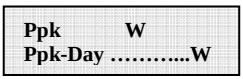
E-da : Daily quantity of energy produced.
$-da: Daily energy savings. The value is expressed in the set currency.



E-tot : Total energy produced since first installation
E-par: Partial energy produced during the period selected by us



P-out : measured instant output power value
In the second line of the display, only the higher of the two temperatures is shown:
T-boost1: booster channel 1 switching device temperature
T-boost2: booster channel 2 switching device temperature



Ppk: maximum peak power value achieved since the "partial" function was activated.
Ppk-Day: indicates the maximum peak power value achieved during the day. The meter is reset when the unit is shut down.

VoutR 230 V Vout AvgR 230 V	VoutS 230 V Vout AvgS 230 V	VoutT 230 V Vout AvgT 230 V

VoutX: measured instant phase / neutral grid voltage
Vout AvgX: average grid phase / neutral voltage calculated over the last 10 minutes of inverter operation.

VoutRS 400 V Vout AvgR 230 V	VoutST 400 V Vout AvgS 230 V	VoutTR 400 V Vout AvgT 230 V

VoutXX: measured instant concatenated voltage

IoutR 5.6 A FoutR 50.01 Hz	IoutS 5.5 A FoutS 50.01 Hz	IoutS 5.8 A FoutS 50.01 Hz

Iout: measured instant grid current value
Fout: measured instant grid frequency value

Vin1 0 V I in1 0.0 A

Vin1: input instant voltage value measured at channel 1 input
Iin1 : input instant current value measured at channel 1 input

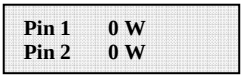
Vin2 0 V I in2 0.0 A

Vin2: input instant voltage value measured at channel 2 input
Iin2 : input instant current value measured at channel 2 input

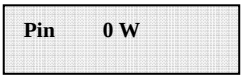
Or:

Vin 0 V I in 0.0 A

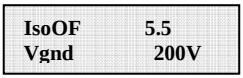
In the case of configuration with one input connected and a second input connected in parallel, this screen is shown instead of the 2 screens previously described.



Pin1: measured input instant power of channel 1
Pin2: measured input instant power of channel 2



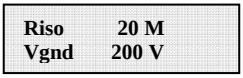
In a configuration with one input connected and a second input connected in parallel, this screen is shown instead of the screen previously described



IsoOF: The value indicates the quality of the earth insulation, with reference to the unitary value which is sufficient for operation. In the example of the screen above, insulation is 5.5 times the minimum.
Vgnd: measured voltage value between the negative earth input.

This screen is only displayed in the case of grounding of the positive or negative terminal.

Or:



Riso: measured isolation resistance value (values greater than 20Mohm are to be considered out of reading range).
Vgnd: measured voltage value between the negative earth input.

This screen will only be displayed if the grounding is disconnected and the channels are configured in parallel.

If there are no problems, OK will be written on the first line of the display, with the current date and time displayed on the second.

In the event of problems with the clock or other inverter parts which are "not vital to the operation of the inverter" (insofar as the unit is still capable of producing energy), the type of problem will be indicated on the second line of the display, in the place of the date and time.
Error messages are as follows:
- CLOCK FAIL indicates problems with the clock, it is necessary to call assistance
- BATTERY LOW battery is low
- ADJ. TIME appears when the unit is first turned on, or after the battery has been replaced
- FAN FAILURE does not affect the correct operation of the inverter; replace the fan at the first convenient opportunity
- MEMORY FAILURE: data collected can no longer be stored. For recovery, it is necessary to call for assistance.

5.5.4 Main menu

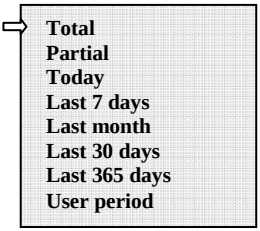
Once the previous grid connection phases and electrical parameter checks have been completed, other screens become available which allows us to monitor the inverter operation from various viewpoints.
By pressing the ESC key (1st key from display) 3 new screens become accessible:

Statistics	Settings	Information

GENERAL QUESTIONS RELATING TO THE USE OF DISPLAY KEYS:
- Pressing the UP and DOWN keys, allows you to move from one entry to the next.
- Pressing the ESC key allows you to return to the previous session described in chapter 5.5.3.
- Pressing ENTER allows you to access the corresponding sub-menu

5.5.5 Statistics

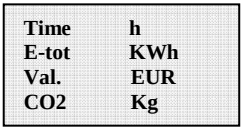
Select the STATISTICS menu to display the following submenu:



The display only shows 2 lines, so to scroll through the entries or open the corresponding submenus, use the keys at the side of the display as described in paragraph: 5.5.3, GENERAL QUESTIONS REGARDING THE USE OF DISPLAY KEYS.
The selected entry will be highlighted by an arrow on the left-hand side of the display, as shown in the figure below:

5.5.5.1 Total

By selecting Total, you can access the following information:



Time: Lifetime operation time
E-tot: Total energy produced
Val. : Economic gain
CO2: CO2 saving compared to fossil fuels

5.5.5.2 Partial

By selecting Partial, you can access the following information:

Time	**h**
E-par	**KWh**
Ppeak	**W**
Val.	**EUR**
CO2	**Kg**

Time: Total operation time since the count was last reset *
E-par: Total energy produced since the count was last reset*
Peak: Measured peak power value since the partial meter was activated
Val. : Economic gain since the count was last reset*
CO2: CO2 saving compared to fossil fuels since the count was last reset*

* Resetting all meters in this submenu can be done be keeping the ESC key depressed (4^{th} from display) for more than 3 seconds. After this time, a sound will repeat three times.

5.5.5.3 Today

By selecting Today, you can access the following information:

E-tod	**KWh**
Ppeak	**W**
Val.	**EUR**
CO2	**Kg**

E-tod: Total energy produced during the current day
Ppeak: peak power value reached during the day
Val. : Economic gain during the current day
$CO^{2:}$ CO2 saving for the current day compared to fossil fuels

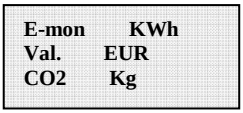
5.5.5.4 Last 7 days

By selecting Last 7 days, you can access the following information:

E-7d: Total energy produced during the last 7 days
Val. : Economic gain during the last 7 days
CO2: CO2 saving over the last 7 days compared to fossil fuels

5.5.5.5 Last month

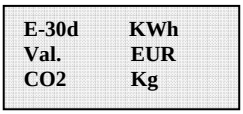
By selecting Last month, you can access the following information:



E-mon: Total energy produced the current month
Val. : Economic gain in the current month
CO2: CO2 saving in the current month compared to fossil fuels.

5.5.5.6 Last 30 days

By selecting Last 30 days, you can access the following information:



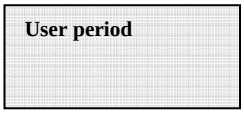
E-30d: Total energy produced over the last 30 days
Val. : Economic gain over the last 30 days
CO2: CO2 saving over the last 30 days compared to fossil fuels.

5.5.5.7 Last 365 days

By selecting Last 365 days, you can access the following information:

E-365: Total energy produced over the last 365 days
Val. : Economic gain over the last 365 days
CO2: CO2 saving compared to fossil fuels over the last 365 days

5.5.5.8 User period



This function measures energy saving during a period selected by us.
By pressing ENTER from the "User period" screen, you can access the following submenu:

To set the start and end dates of the chosen period, use the display keys:

- Use ENTER to scroll from one field to the next (from left to right)
- Use ESC to return to the previous field (from right to left)
- Press ESC repeatedly to return to the previous menus, as described in chapter 5.5.3

To set the day:

- Use DOWN to scroll through the numbers in descending order (from 31 to 1)
- Use UP to scroll through the numbers in ascending order (from 1 to 31)

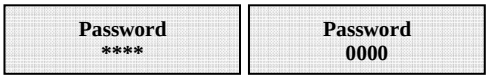
To set the month:

- Use DOWN to scroll through the months from December to January
- Use UP to scroll through the months from January to December

If an invalid date is entered, the display will show the following:

5.5.6 Settings

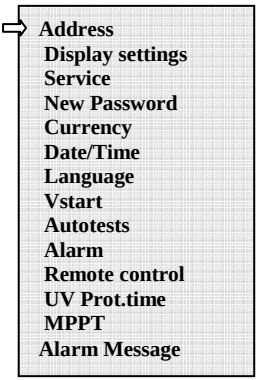
If you select SETTINGS from the Main menu (chapter 5.5.4), the first screen will appear on the display, concerning the password:



The default password is 0000. It can be changed using the display keys in the usual way:

- Use ENTER to scroll from one figure to another (from left to right)
- Use ESC to return to the previous figure (from right to left)
- Press ESC repeatedly to return to the previous menus, as described in chapt.5.5.3
- Use DOWN to scroll through the numbers in descending order (from 9 to 0)
- Use UP to scroll through the numbers in ascending order (from 0 to 9)

After having entered the correct password, press ENTER to access to the different information saved in this section:



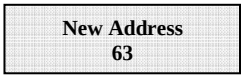
The display only shows 2 lines, so to scroll through the entries and access each of the submenus, use the UP and DOWN buttons.

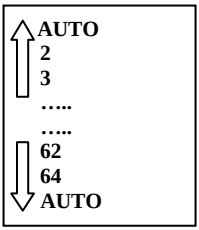
GENERAL QUESTIONS REGARDING READING THE DISPLAY.

The selected entry will be highlighted by an arrow on the left-hand side of the display. Once the chosen entry is selected, press ENTER to enter its submenu.

5.5.6.1 Address

Using this function, you can set the addresses for the communication of individual inverters connected to the system on the RS485 line. The numbers assigned can go from 2 to 63. Use the UP and DOWN keys to scroll through the numbers.

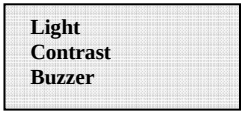




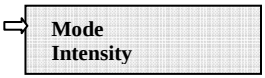
The 'AUTO' selection is not usable at the moment

5.5.6.2 Imp. Display

This function allows you to set the display characteristics:



1) **Light**: display light setting:



- With the MODE key, it is possible to control the display backlighting.
After selecting the Mode entry with the arrow and pressing ENTER, you will access the following submenu. The next screen is:

ON : Light always on
OFF : Light always off

AUTO: Automatic light management. The light turns on every time a key is pressed, and remains on for 30 seconds before gradually turning itself off.
- The INTENSITY key allows for the regulation of backlight intensity on a scale of 1 to 9

2) **Contrast :** Display light contrast
The scale of the display's light tones go from 0 to 9.
To select the number, press the UP and DOWN keys to scroll and then ENTER to confirm your choice.

3) **Buzzer:** key tone setting
Selecting:
ON : key tones are on
OFF : key tones are off

5.5.6.3 Service

Only installation staff may access this function. A dedicated password, only supplied by Power-One is necessary to gain access.

5.5.6.4 New password

This function is used to change the default password, 0000.
To enter your own personal code, the display keys must be used in the following way:

- Use ENTER to scroll from one digit to another (from left to right)
- Use ESC to return to the previous digit (from right to left)
- Press ESC repeatedly to return to the previous menus, as described in chapter 5.5.3
- Use DOWN to scroll through the numbers in descending order (from 9 to 0)
- Use UP to scroll through the numbers in ascending order (from 0 to 9)

5.5.6.5 Currency

This function regards the energy output earnings.

Name	**EUR**
Val/KWh	**00.50**

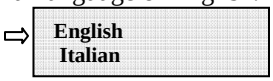
Name: set the desired currency using the keys in the same way. The default currency is the Euro.
Val/KWh: indicates the cost of 1 KWh expressed in the set currency. The default setting is 0.50 Euros.

5.5.6.6 Date/Time

The time and date can be modified from this section, if necessary.

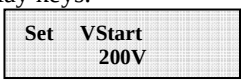
5.5.6.7 Language

It is possible to set your national language or English.



5.5.6.8 START-UP Voltage

The start-up voltage can be adjusted (if they are configured independently) also separately for both channels in order to tailor it to the needs of the system. The voltage range is from 120V to 350V. The default setting for Aurora is 200V. This parameter may be varied by using the display keys.



5.5.6.9 Autotest Operation

In accordance with the "guide for connection to the ENEL power supply distribution grid", the autotest can be launched through the menu on the display or by using an RS485/USB converter and the Aurora Communicator software (see paragraph 5.6 for further details).

The following conditions are necessary for the Autotest to be performed:

- You must have set the ENEL grid standard.
- The inverter must be connected to the grid in a way that allows simulating a disconnection condition.
- Do not carry out any operation during the test execution phase.
- Check that the device is connected to the grid in a stable way

Follow the procedure below in order to perform Autotest:

- Access the menu SETTINGS > Autotest
- In the section of the menu dedicated to the Autotest, the type of test that the device must start may be selected from the following:

OV Test	Disconnection from distribution grid due to "Overvoltage"
UV Test	Disconnection from distribution grid due to "Undervoltage"

OF Test	Disconnection from distribution grid due to “Maximum frequency”
UF Test	Disconnection from distribution grid due to “Minimum frequency”

- OV Test

During this test, the limit set for the maximum grid voltage (AC) is reduced gradually until reaching the threshold for which the disconnection of the inverter from the distribution grid occurs.

Performing test
…….

At the end of the test, when the inverter has disconnected itself from the grid, the test result will be shown on the display:

Test V= …. V
OK T= ….ms

Pressing the ESC key will allow you to return to the Autotest menu, from which you can select another test.

- UV Test

During this test, the limit set for the maximum grid voltage (AC) is increased gradually until reaching the threshold for which the disconnection of the inverter from the distribution grid occurs.

Performing test
…….

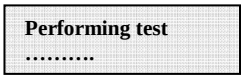
At the end of the test, when the inverter has disconnected itself from the grid, the test result will be shown on the display:

Test V= …. V
OK T= ….ms

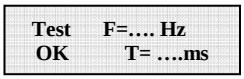
Pressing the ESC key will allow you to return to the Autotest menu, from which you can select another test.

- OF Test

During this test, the limit set for the maximum grid frequency (AC) is reduced gradually until reaching the threshold for which the disconnection of the inverter from the distribution grid occurs.



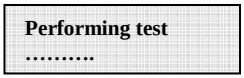
At the end of the test, when the inverter has disconnected itself from the grid, the test result will be shown on the display:



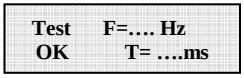
Pressing the ESC key will allow you to return to the Autotest menu, from which you can select another test.

- UF Test

During this test, the limit set for the maximum grid frequency (Hz) is increased gradually until reaching the threshold for which the disconnection of the inverter from the distribution grid occurs.



At the end of the test, when the inverter has disconnected itself from the grid, the test result will be shown on the display:



Pressing the ESC key will allow you to return to the Autotest menu, from which you can select another test.

5.5.6.10 Alarm

The inverter is equipped with an alarm system which allows for the switchover of a relay contact (available both as a contact normally set open - N.O. - and as a contact normally set closed– N.C.). The relay contacts are accessible from the front cover as shown in **Error! Reference source not found.**. This contact can be used, for example, to activate an acoustic or visual alarm. In any case, the contact voltage/current rating of 230V/1A must not be exceeded.

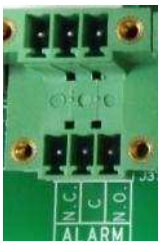


Fig. 22 - Alarm contact terminal block

This function can activate 4 different modes of alarm. By pressing the ENTER key, you can access the following submenu:

⇨ **Production**
Alarm
Alarm (conf.)
Twilight

The selected entry is highlighted by an arrow on the left-hand side of the display. Use the UP/DOWN keys to change your selection and the ENTER key to confirm.

- **PRODUCTION:** the relay is only activated when the inverter is connected to the grid.

For example, if the N.O. (or N.C.) contact is chosen, the contact will remain open (closed) until the inverter is connected to the grid; once the inverter is connected and begins to transfer power, the relay will switch its status to closed (open). When the inverter disconnects itself from the grid, the relay contact returns to its rest position, i.e. open (closed).

- **ALARM**: the relay is activated in the case of alarm (code E).

For example, if the N.O. (or N.C.) contact is chosen, it will remain open (closed) until an error occurs in the inverter (IT DOES NOT SWITCH OVER IN CASE OF WARNING or code W); once an error has occurred in the inverter, the relay switches its status to closed (open). The contract remains in this position, i.e. switched over with respect to its rest position, until normal operation, i.e. operation in parallel with the grid, is restored.

- **ALARM (conf.)**: the relay switches over in the event of alarms (code E) or warnings (code W) chosen from a list by the user (the list may also show selections which are not designed for the specific model, consult table 5.4 when choosing).

For example, if the N.O. (or N.C.) contact is chosen, the contact will remain open (closed) until in the inverter an error occurs or warning is issued from those selected; once in the inverter the error has occurred or warning issued, the relay switches its status to closed (open). The contract remains in this position, i.e. switched over with respect to its rest position, until the error code or warning is solved.

- **TWILIGHT:** the relay switches only when the input voltage set for grid connection is exceeded.

For example, if the N.O. (or N.C.) contact is chosen, the contact will remain open (closed) until the inverter reaches a Vin which is greater than that selected for grid connection. The contact will remain in this position, i.e. switched over with respect to its rest position, for the time the inverter is on (even if disconnected from the grid). This mode is useful for disconnecting any large output transformers which may incur large levels of consumption during the night.

To select the alarm contact operating mode, access the Alarm submenu from the Settings menu, select the desired operating mode by using the UP and DOWN arrows, and push the ENTER key to confirm your choice.

5.5.6.11 Remote Control

This setting is used to enable/disable the inverter remote switch-off function through the appropriate control signal (on the signal terminal box).

If you choose to enable this option, it will be possible to control Aurora's ON/OFF function by connecting a relay contact or switch between the +R and –R contacts.

Remote ON/OFF Enable	**Remote ON/OFF Disable**

- **Disable**: Aurora operation is automatic, depending on the radiation conditions (and grid presence), and is not influenced by the condition of the control contact.
- **Enable**: by closing the contact between +R and –R, Aurora is forced to shut down. The state of the control signal can be read from the internal microprocessor and alternatively, if this is closed, the display will show the forced OFF status.

Remote OFF	**Waiting Rem.ON… to restart**

5.5.6.12 UV Prot.time

Using this function it is possible to set the length of time for which the inverter will remain connected, after input voltage drops below the Under Voltage limit fixed at 70% of the activation voltage.

Power-One sets this time at 60 seconds. The user may change this setting, from 1 to 3600 seconds.

T Protez. UV 60 secs

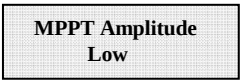
For example, having set the UV Prot. time at 60 seconds, if Vin voltage drops below 90V at 09.00, the inverter will remain connected to the grid (at 0 power) until 09.01.

The default time is set at 60 seconds. The user may change this setting, from 1 to 3600 seconds.

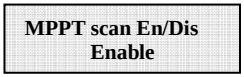
5.5.6.13 MPPT

This function is used in order to set the parameters for the Maximum Power Point Tracker function.

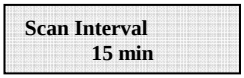
MPPT Amplitude: this setting allows you to choose the amplitude of disturbance introduced in DC in order to establish the optimal work point. There are 3 choices (LOW, MEDIUM, HIGH). The default setting is MEDIUM.



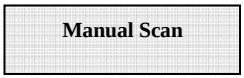
You can enable or disable the scan function to identify the maximum multiples.



The time interval for system maximum multiples scans can be set using this function. The default setting is 15 minutes.



You may also decide to perform a manually scan, by using the specific control



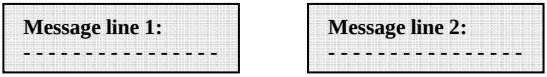
5.5.6.14 Alarm Message

Follow the procedure described below in order to program the error message that will be shown on the display:

Pressing the ENTER key will allow you to access the relevant submenu

Move the selection arrow using the UP and DOWN keys, press ENTER to navigate the submenus or select the functions.
Once the personalized message has been enabled, you must compose the message itself.

Upon selecting Compose Message you will be able to write the first line of the message.



The maximum numbers of characters is 16. Pressing the Enter key 17 times will allow you to move to the second line.

To write the message, use the display keys, following procedure below:

- Use the ENTER key scroll from one position to the next (from left to right)
- Use the ESC key to return to the previous position (from right to left)
- Press the ESC key several times to return to previous menus, as described in chapter 5.5.3
- Use the UP key to scroll through the numbers, letters and symbols in ascending order
- Use the DOWN key to scroll through the numbers, letters and symbols in descending order

5.5.7 Info

From this menu, you can access all the Aurora inverter data and display the grid standard and the chosen language through the specific selectors.

The menu is structured as follows:

- Product ID (part number)
- Serial No. (serial number, week, year of production)
- Firmware (firmware revision level)
- Country Selector
- Current value (currently set standard)
- New value (standard that will be set upon re-start if the switches are switched over)
- Set new (manually set the new selected standard)
- Residual time (for which it is still possible to change the applied standard)

The last menu allows you to see which standard is currently set in the inverter (Current Value); which will be applied to the next start-up (New Value) after acting on the selectors; manually set the new value (Set New Value); and set the time remaining for making changes to the applied standard (Residual Time).

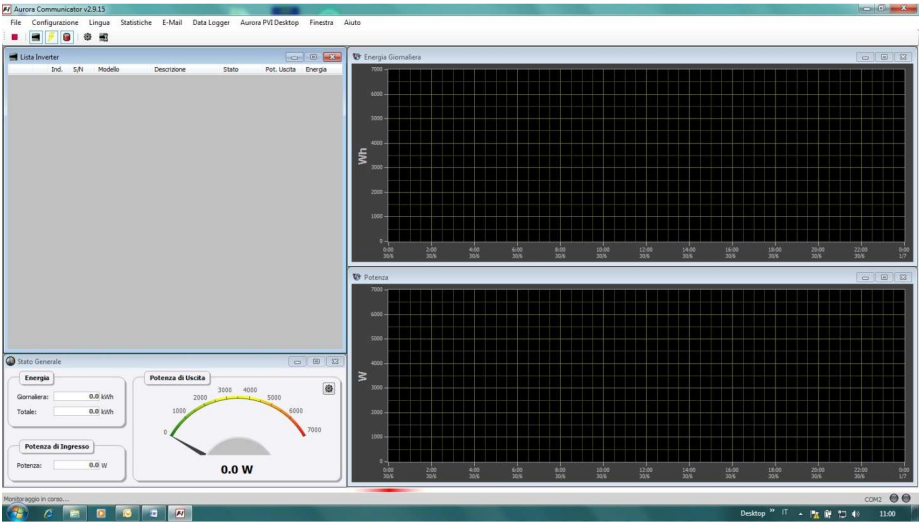
When the Residual Time is finished, it will no longer be possible to make changes to the applied standard and an unblocking code will be needed (see paragraph 3.4.7). The time period is 24 hours of operation with the inverter connected to the power supply grid.

5.6 AUTOTEST PROCEDURE BY USING AURORA COMMUNICATOR

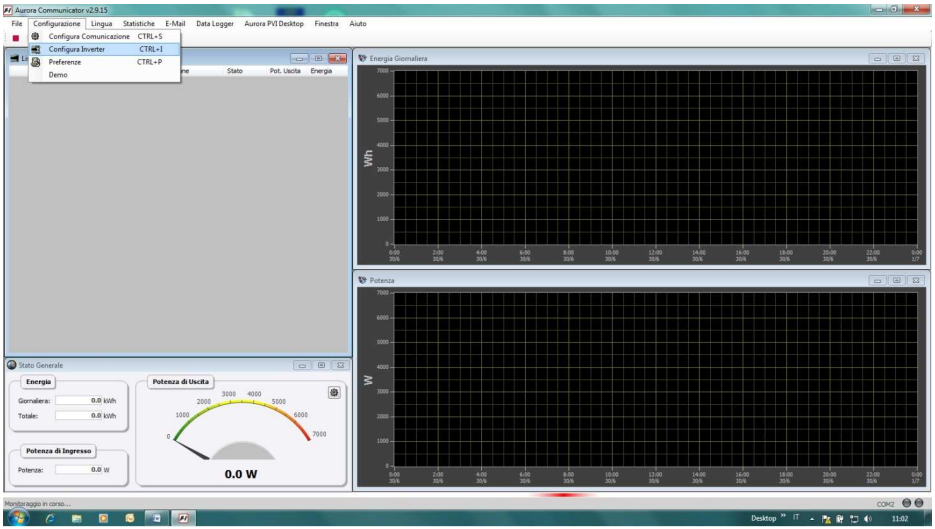
The Autotest procedure can be carried out by using the Aurora Communicator software, included in the CD provided.
To carry out autotest, follow the procedure below:

- Install the Aurora Communicator software on your PC.
- Connect the inverter to the PC by using the RS485/UBS converter
- Start-up the Aurora Communicator software

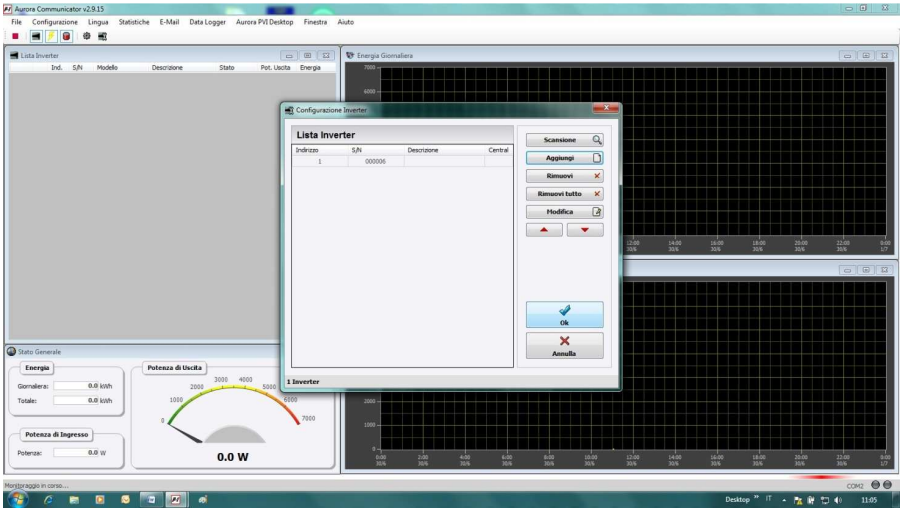
The start-up screen will be displayed:



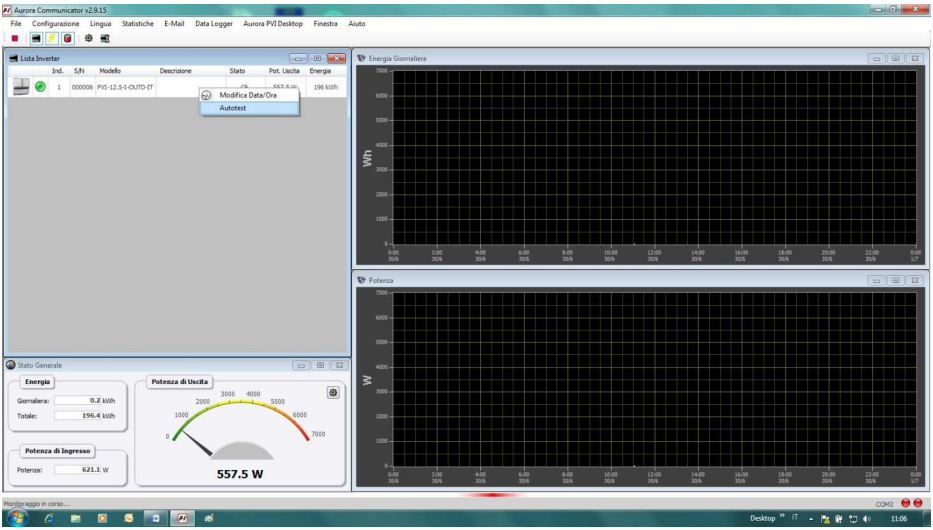
- Click on Configuration > Configure Inverter



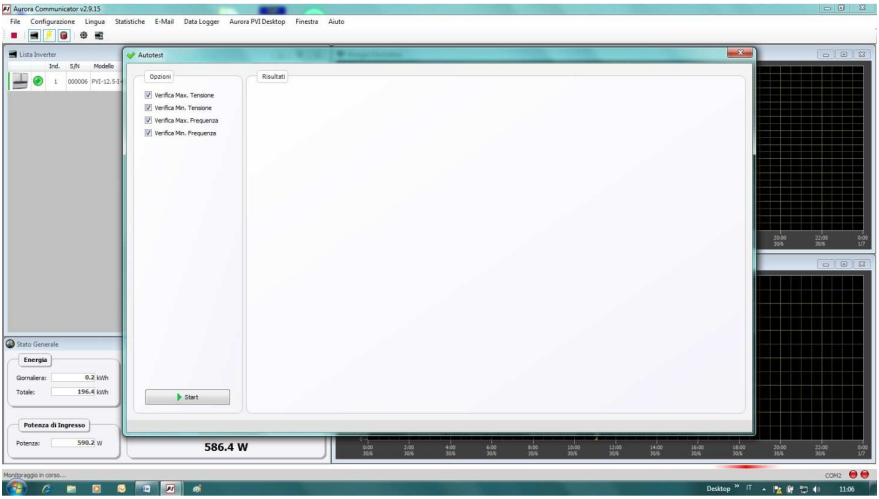
- In the "Configure inverter" window, click on "Scan": all the connected inverters will be shown under "Inverter list". Select the inverter upon which the autotest is to be performed and press "OK"



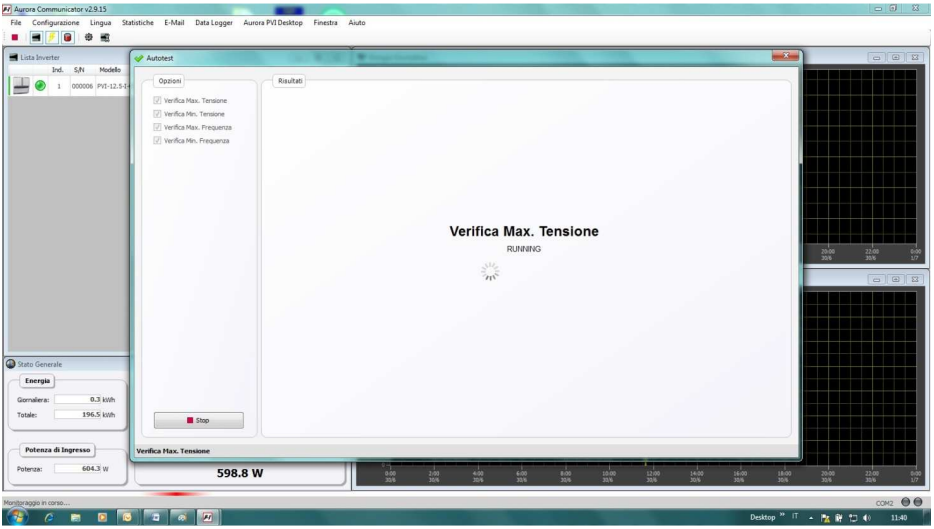
- On the start-up page, the selected inverter will now be shown. Right-click on the S/N of the inverter and click “Autotest”.



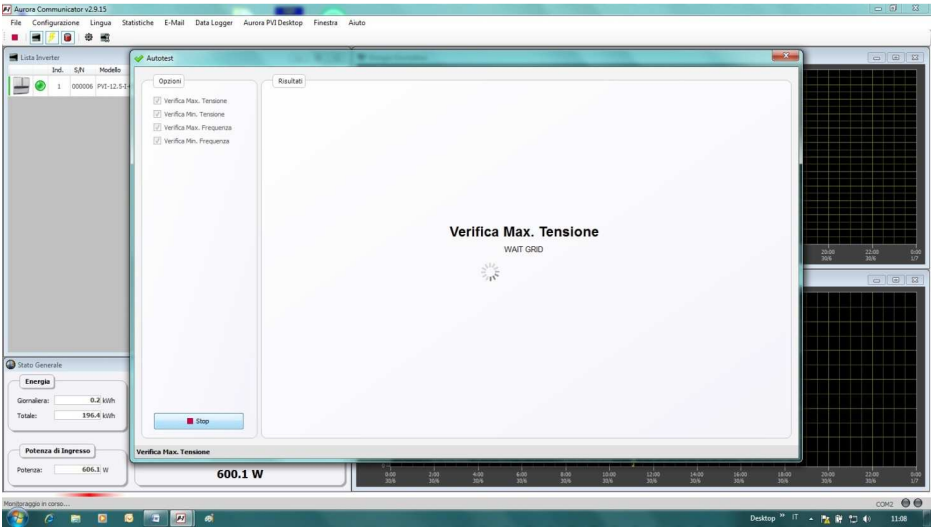
- Select the test or tests of interest (check max voltage, check min voltage, check max frequency, check min frequency), checking off the corresponding check boxes and clicking on the start button to launch the test.



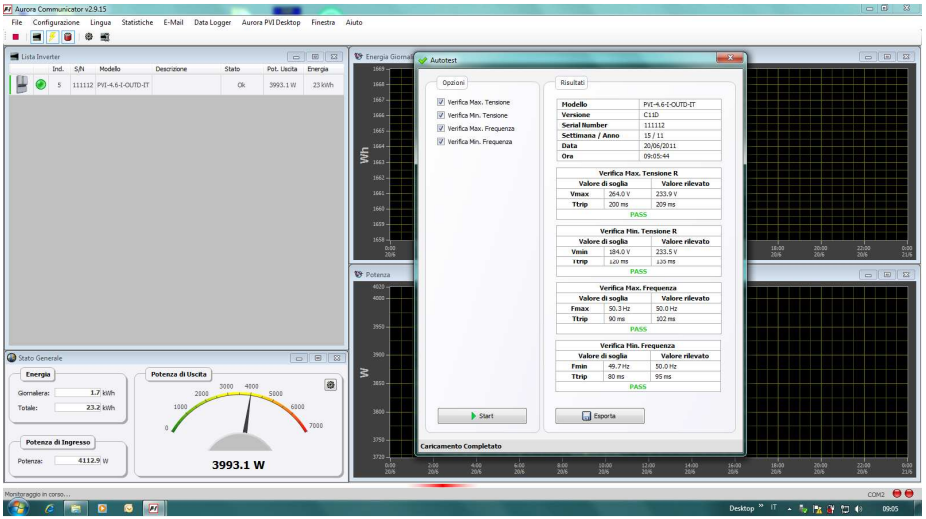
- The inverter will perform all of the tests selected in sequence, displaying its progress



- At the end of each test, the “wait grid” screen will appear, while awaiting the inverter to re-connect to the grid.



When the Aurora Communicator has completed all of the requested tests, a summary screen will appear reporting the results of the various tests.



NOTE: Click on the Export button to export the test results onto your PC in .csv or .txt format

6 DATA CHECK AND COMMUNICATION

6.1 Connection through RS-485 serial port or RJ45 connectors

6.1.1 RS-485 serial port

The RS-485 serial port uses a three-wire cable: two for signals and a third for ground connection. The cable should be passed through the holes located on the bottom of the inverter, closed with airtight plugs (see
Fig. 23).
The supplied cable gland must be installed into the appropriate hole (replacing one of the caps).

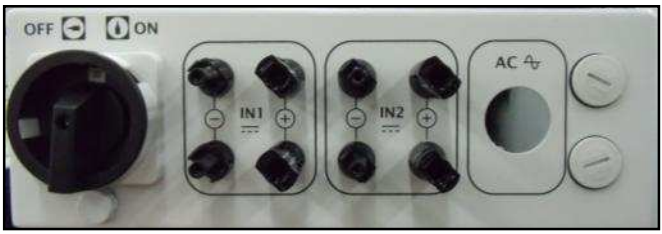


Fig. 23 - Cable routing for RS-485 connection

For ease of installation, the inverter is provided with two holes to differentiate the input cable route from the output cable route when several units are connected in a daisy chain as described below.

Once the cables have been passed through the cable gland, they are connected inside the unit to the RS-485 terminal blocks which can be accessed by removing the front cover. Refer to par. 3.4.2. for information on correct front cover removal and reassembly.

- The signal wires must be connected to the +T/R and –T/R terminals
- The ground wire must be connected to the RTN terminal

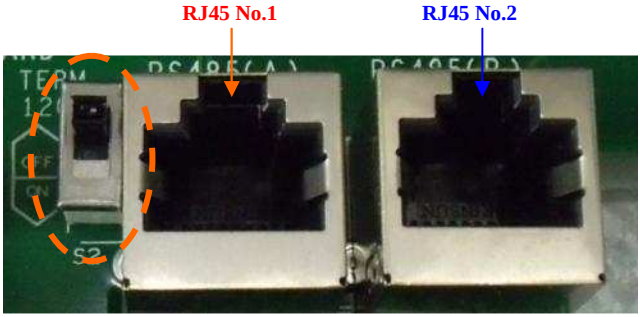


Fig. 24 - Terminals for connection to RS-485 and S2 switch

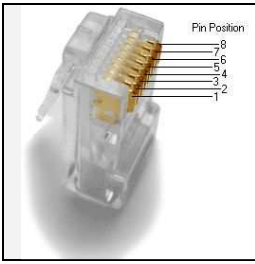
6.1.2 RJ45 connectors

Alternatively, the RS485 serial connection of the inverters, whether as single units or a daisy chain, can be performed by means of RJ45 connectors (see Fig. 24)

The wiring must be routed through the holes closed with airtight plugs, located on the bottom of the inverter (see Fig. 23). Input wiring passes through one hole and is assembled to one of the RJ45 connectors; output wiring passes through the other hole and is assembled to the RJ45 connector of the next unit.

It does not matter whether it is no.1 or no.2 insofar as, being connected in parallel, the signals are the same.

RJ45 connectors			
	Pin #	**Signal Name**	**Description**
	1		Not Used
	2		Not Used
	3	**+TR**	***+ Data Line*** (RS485 Communication)
	4	**+R**	***Remote OFF*** Remote control (see paragraph 5.5.6.10 for details).
	5	**-TR**	***- Data Line*** (RS485 Communication)
	6		Not Used

	7	**RTN**	***Signal Return*** (Common mass for logical signals)
	8		Not Used

6.1.3 Daisy chain

The RS-485 terminal block or RJ45 connectors can be used to connect a single AURORA inverter or multiple inverters, connected in a daisy chain. The maximum number of inverters that may be connection in a daisy chain is 62. The recommended maximum length of this chain is 1000 meters.
If several inverters are connected in a daisy chain, it will be necessary to assign an address to each. See paragraph 5.5.6.1 for information on changing addresses.
Furthermore, the last inverter in the chain must have the line termination contact of the activated line (switch S2 -120Ω TERM in ON position) see
Fig. 24.

Each AURORA is provided with default address two (2) and with the S2 switch in the OFF position.
In order to ensure optimum communication on the RS485 line, Power-One recommends connecting the PVI-USB-RS485_232 adaptor between the first unit of the daisy chain and the computer. See Fig. 25 for details. (RS485-USB Converter)
For this purpose, other equivalent devices found on the market may also be used, however, since they have never been specifically tested, Power-One does not guarantee the correct operation of the connection.
Please note that these devices may also require an external termination impedance, which is not necessary for the Aurora PVI-USB-485_232.
The following diagram shows how to connect units in a daisy chain configuration.

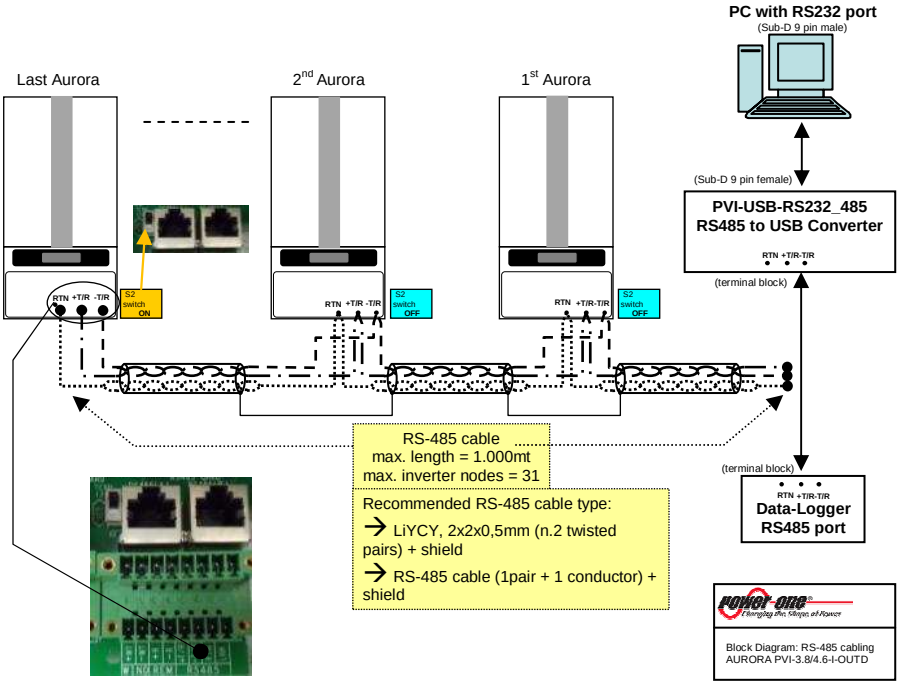


Fig. 25 - Daisy chain connection

NOTE: when using an RS-485 connection, there may be up to 62 inverters connected on the same chain. Choose any address between 2 and 63

NOTE: when using an RS-485 connection, if one or more inverters are subsequently added to the system, remember to switch back to the OFF position the system inverter switch that before was the last one in the system.

7 TROUBLESHOOTING

The AURORA inverters conform to the standards predefined for their operation in connection with a grid, for safety, and electromagnetic compatibility.

Before the product is delivered, several tests are successfully performed to check the operation, protection devices, performance, and durability of the equipment.

These tests, together with Power-One quality guarantee system, ensure optimal operation of AURORA.

If the inverter should malfunction, however, solve the problem as follows.

- ✓ Work in safe conditions as described in chapter 3.5, checking that the connections between AURORA, the photovoltaic field, and the distribution grid have been made correctly.

- ✓ Carefully observe which of the LEDs is flashing, and read the text on the display. After having done this, follow the instructions in chapters 5.3, 5.4, 5.5. in order to identify they kind of anomaly which is occurring.

If the instructions in this document do not help in eliminating the problem, contact the help service or the installer (see the instructions in the following page).

Before contacting the help service, we ask you to have to following information close to hand in order to maximize the efficiency of the operation:

INFORMATION ON AURORA

NOTE: Information available directly from the LCD display

- ✓ AURORA model?
- ✓ Serial number?
- ✓ Week of production?
- ✓ Which LED is flashing?
- ✓ Intermittent or steady light?
- ✓ Which signals are shown on the display?

- ✓ Brief description of the fault?
- ✓ Have you noted if the fault can be reproduced?
- ✓ If so, in what way?
- ✓ Have you noted if the fault repeats itself cyclically?
- ✓ If so, how often?
- ✓ Was the fault present at the time of installation?
- ✓ If so, has it worsened?
- ✓ Describe the atmospheric conditions present at the time the fault appeared

INFORMATION on the Photovoltaic Field

- ✓ Brand and model of photovoltaic panels
- ✓ System structure
  - maximum array voltage and current values
  - number of strings in the array
  - number of panels per string

8 TECHNICAL SPECIFICATIONS

8.1 Input values

WARNING: the photovoltaic field and system wiring must be configured in such a way that the PV input voltage is less than the maximum upper limit, independent of the model, number and operating conditions of the chosen photovoltaic panels.
As the panel voltage also depends on the operating temperature, the choice of the number of panels per string must take into account the minimum ambient temperature for that specific area (see table A).

WARNING: the inverter is provided with a linear output derating depending on the input voltage, from 470 Vdc (100% output power) to 520 Vdc (0% output power)

WARNING: the open circuit voltage of the photovoltaic panels is affected by the ambient temperature (the open circuit voltage rises as temperature drops) and it is necessary to ensure that the minimum expected temperature for installation does not cause the panels to exceed their maximum upper voltage limit of 520 Vdc. The table below is an example which indicates the maximum voltage for each panel for typical panels of 36, 48, 60 and 72 cells, depending on temperature (assuming a rated open circuit voltage of 0.6 Vdc for a cell at 25°C and a temperature coefficient of -0.0023 V/°C. The table thus shows the maximum number of panels that may be connected in series, depending on the minimum operating temperature. Consult the panel manufacturer for the correct temperature coefficient of V_{oc} before calculating the maximum voltage of the photovoltaic array.

Panel min. temp. [°C]	36-cell panel		48-cell panel		60-cell panel		72-cell panel	
	Panel voltage	Max. number of panels	Panel voltage	Max. number of panels	Panel voltage	Max. number of panels	Max. number of panels	Panel voltage
25	21.6	24	28.8	18	36.0	14	43.2	12
20	22.0	24	29.4	18	36.7	14	44.0	12
15	22.4	23	29.9	17	37.4	14	44.9	12
10	22.8	23	30.5	17	38.1	14	45.7	11
5	23.3	22	31.0	17	38.8	13	46.5	11
0	23.7	22	31.6	16	39.5	13	47.3	11
-5	24.1	22	32.1	16	40.1	13	48.2	11
-10	24.5	21	32.7	16	40.8	13	49.0	11
-15	24.9	21	33.2	16	41.5	13	49.8	10
-20	25.3	21	33.8	15	42.2	12	50.7	10
-25	25.7	20	34.3	15	42.9	12	51.5	10

Table A

Description	Value PVI–3.8-OUTD	Value PVI–4.6-OUTD
Maximum input power	4420 W	5260 W
Rated input power	4000 W	4840 W
Rated input voltage	330 Vdc	
Max. absolute input voltage	520 Vdc	
Input voltage, MPPT operating range	from 90 Vdc to 520 Vdc	
Input voltage, MPPT operating range at full power	from 200 Vdc to 470 Vdc	
Max short circuit current (of each array)	15.6 Adc	17 Adc
Max. operating input current (of each array)	12.5 Adc	14 Adc
Max. input power (of each array)(1)	3000 W	
PV ground fault protection	Isolation detection system + PTC	
Input channel configuration (array)	Parallel / Independent (2)	

(1) The total input power must remain within the max. recommended DC power value
(2) The independent channel configuration cannot be used with positive grounding setting

NOTE: If the photovoltaic field connected to the inverter supplies an input current which is greater than the maximum usable value, the inverter will not be damaged as long as the input voltage is within the permitted range.

8.2 Output values

Description	Value PVI–3.8-OUTD	Value PVI–4.6-OUTD
Rated output power	3800 W	4600 W
Grid voltage, maximum operating range	180 / 264 Vac	
Grid voltage, rated	230V	
Grid frequency, maximum range	47 / 63 Hz	
Grid frequency, rated	50Hz	
Rated output current	16.5 A	20 A
Max. output current	18.2 A (16 A for UK Version G83/1)	22.5 A
Output over current protection	20 A	25 A

8.3 Grid protection characteristics

Anti-islanding protection	Complies with: ➢ Guide for connection to the ENEL power supply distribution grid ➢ VDE V 0126-1-1 ➢ Royal Decree RD1663/2000 of Spain ➢ UK G83/1

8.4 General characteristics

Description	Value PVI–3.8-OUTD	Value PVI–4.6-OUTD
Maximum efficiency	96.5%	
Internal consumption in stand-by mode	< 8 W	
Internal consumption at night	< 2 W	
Operating ambient temperature	from -25°C to +60°C (*)	
Environmental category	For outdoor use (Outdoor)	
Pollution degree	3	
Overvoltage category (in compliance with IEC 62109-1	II (Input DC circuit) III (Output AC circuit)	
Level of casing protection	IP65 / Nema 4X	
Audible noise when internal fan is operating	< 50 dbA @ 1m	
Size (height x width x depth):	712 x 325 x 222 mm	
Weight	24 kg	
Relative humidity	0 – 100 % condensation point	
Working altitude	2000 meters max.	

(*) Full power guaranteed up to Amb.T. = 50°C for PVI-4.6-I-OUTD or 60°C for PVI-3.8-I-OUTD (provided that it is not exposed to direct solar radiation)

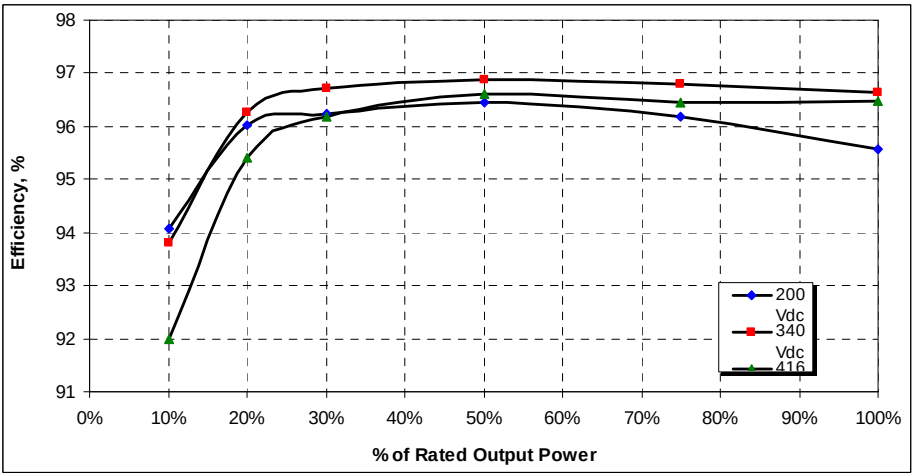


Fig. 26 - Efficiency curve PVI-3.8-OUTD

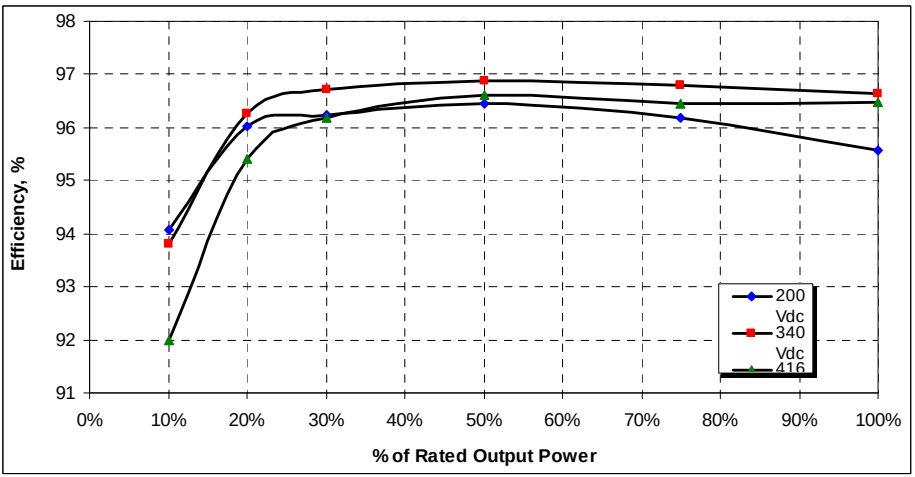


Fig. 27 - Efficiency curve PVI-4.6-OUTD

8.5 Power Derating

In order to ensure inverter operation in safe thermal and electrical conditions, the unit automatically reduces power input to the grid.
Power derating may occur in two cases:

Reduction in power due to environmental conditions
The degree of power reduction, and the temperature at which it starts occurring, also depend, besides ambient temperature, on many operating parameters, including, for example, input voltage, grid voltage, and power available from the photovoltaic field. AURORA, therefore, can reduce power during certain periods of the days according to the value of these parameters.
However, AURORA guarantees maximum power up to an ambient temperature of 50°C for PVI-4.6-I-OUTD, and of 60°C for PVI-3.8-I-OUTD, provided that it is not exposed to direct solar radiation.

Reduction in power due to input voltage
The chart shows the automatic reduction in power output when input or output voltage is too high or too low.

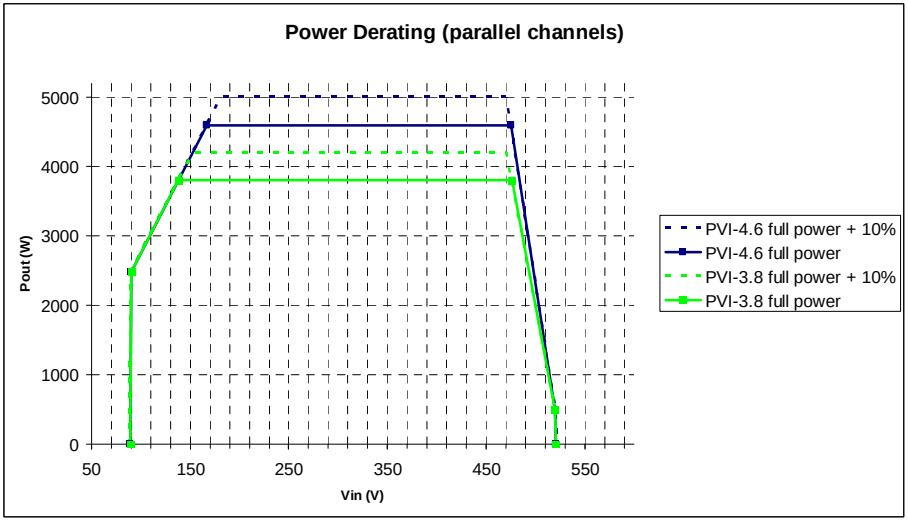


Figure 28 – Derating curve compared to input voltage - Use of both channels

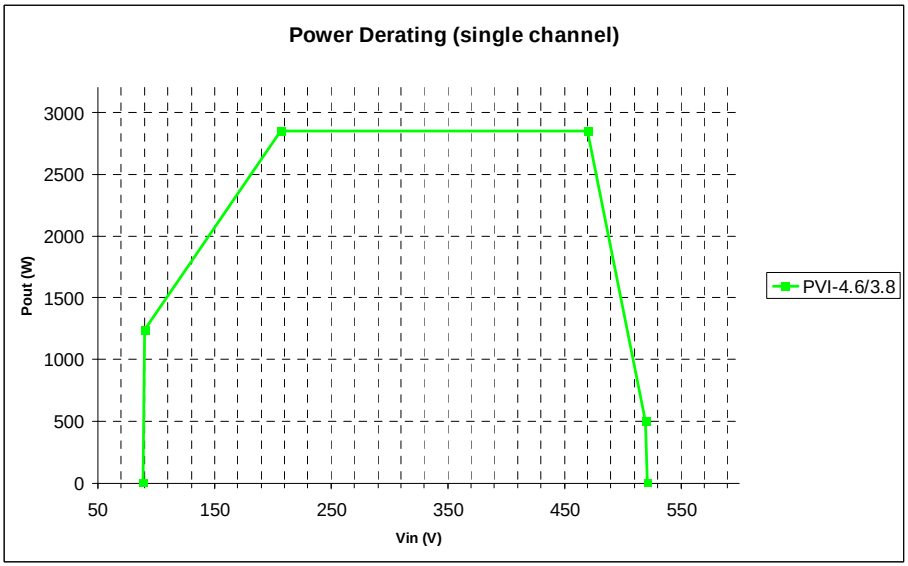


Figure 29 – Derating curve compared to input voltage - use of only channel IN1

NOTE: The curves show a zone of non operation up to 90V; a linear derating zone up to 170V (PVI-4.6), and 140V (PVI-3.8); a zone of constant rated power; and a high-voltage derating starting at 470V. Actually, the low-voltage operating zone depends on the setting of the minimum starting voltage (200V default). Once the converter is switched on it will continue to operate according to the curves, up to a minimum value of 70% of the set starting voltage (i.e. with a default value of 200V, the converter will have a minimum operating voltage of 140V).

Conditions for power reduction due to environmental conditions and input voltage may occur at the same time but power reduction will always occur with reference to the lower detected value.